THE AEROPLANE

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Aeronautical Engineering
Edited by - - THURSTAN JAMES

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LET'S GET DOWN TO POLICY

EVERY year the Royal Aeronautical Society holds what is called a garden party. This year, in spite of the fact that the venue was not a garden and the weather was hardly summerlike, the party at White Waltham on Sunday last was generally acknowledged to be among the most successful of its kind. Those who deprived themselves of the pleasure of going because the weather forecasts were not sufficiently optimistic have only themselves to blame for being too faint-hearted.

In fact the weather from 3 o'clock onwards, when the President and Lady Hall were officially free to watch the flying, until nearly 6 o'clock, when the party had been officially over for nearly an hour, was free from rain. The unstable nature of the atmosphere, as our sail-planing friends would say, resulted in the most photogenic cloudscapes. Against the masses of the towering, threatening thunderheads, the brightly painted cowlings of the Tiger Club's Tiger Moths made splashes of Cuneo-like colour.

Unfortunately, we cannot devote this editorial to this successful R.Ae.S. occasion. Our purpose in broadly brushing in the backcloth is to lead our readers to that hangar in Fairey's installation on White Waltham airfield where the Rotodyne was railed off for inspection. We were surprised to find how few of the visitors around it realized that its immobility was due to the fact that it has no engines with which to fly. Those who have seen it cavorting about the sky at 145 knots may at first be slow in realizing that there is no large pool of power-plants on which the engineers of the Fairey Aviation Company may draw in their untiring efforts to accelerate the development period of the most promising aircraft that the British aircraft industry has on the stocks today. When the Napier Elands have run their allotted span they have to be returned for inspection. And until they have been cleared for further use all experimental flying has to stop.

This provides us with the text of our discourse. Without faith the mountains will remain unmoved. And the British Treasury, it appears, has no faith in the future of the British aircraft industry.

Perhaps we may remind our readers that in the years between the Wars one of the sights at the R.A.F. Hendon Air Displays was the demonstration of aerial refuelling. This is something which was dropped in this country until it was picked up by the United States, but now that the U.S.A.F. is refuelling its aircraft all round the clock, and that mostly with Flight Refuelling devices, refuelling has been taken up in this country again. Are we going to allow the Fairey Rotodyne to be dropped until the United States have a few thousand rolling off the production lines? What, in fact, are we up to?

As we all know, the Rotodyne is not the only British development in the doldrums. There is a most interesting private venture slowly being constructed at Kingston. This long-range strike fighter is being put together as fast as private venture funds from aircraft maker and engine maker will allow, but that is not very fast. Even slower is the progress being made towards supersonic and vertical-lift airliners. There are at least three separate schemes for vertical-lift besides the Rotodyne. Some of them make use of new developments of fan lift. But precious little is being done about them. Work on the vital all-steel research supersonic aircraft at Filton, we hear, is getting slower and slower.

We have recently been told that some forty thousand troops are now holding one of our few remaining bases, the turbulent copper island against the mainland of Asia Minor. With the aid of many flights by Comets and Beverleys and Hastings we have airlifted a few battalions of troops thither. The demonstration, no doubt satisfying to those who have had to carry out the exercise with limited resources, is scarcely encouraging to those who know what is involved in moving not only troops but their heavy equipment about in double-quick time. If one discusses the situation with the chaps in the Army, one finds precious few illusions about the scarcity of the proper weight-lifting long-range aircraft. The trouble is that these views get wedged in the interdepartmental machinery.

The sudden change in the international political climate must have made clear to everybody that the continued existence of the Commonwealth does not just depend upon the warm desire of the English to be friends with the rest of the world. It depends solely upon the ability of this country to pull its weight and stand by its allies. This can only be done if British Air Power means something.

Air Power, as we have so often said, is indivisible. It means military aeroplanes; it means civil aeroplanes and it means trade in aeronautical equipment. At the moment only the last is flourishing. And that must eventually lose momentum if we do not press on with development. The engineless Fairey Rotodyne must be regarded as a warning, not as a symbol. We must have a policy and we must have a body to set that out. And, as what we have said is true whatever party is in power, the sooner we get a non-party policy-formulating committee for aeronautical progress the better.

B

MATTERS OF MOMENT

Rolls-Royce Rockets

IN his annual chairman's statement to the Rolls-Royce shareholders, Lord Kindersley reports that during the past year considerable progress has been made on the development of the company's rocket engines for guided weapons. Indeed, he reveals that engine testing is already being carried out on "temporary facilities."

What these facilities are, Lord Kindersley does not make known. But presumably, as "engine testing" as such is involved, this must be in progress on the larger test-beds at R.A.E. Westcott.

The new rocket-engine test site at Spadeadam Waste in Cumberland, which is to be used for the Rolls-Royce rocket engines, is not yet ready. In this connection, Lord Kindersley said that construction of the test site was well advanced and that it was expected that if present progress were to be maintained the first portions would be handed over for use during the next year.

"The provision of these test facilities in a remote location," he went on, "has been a major task involving considerable civil engineering work. . . . With the completion of these facilities the development of our motors will proceed more rapidly and in close association with de Havilland Propellers, Ltd., who are developing the missile."

A Slow Lift To Cyprus

THE recent prolonged airlift of troops from Britain to Cyprus to reinforce a critical area of the Middle East has shown that if the idea of a U.K.-based "fire brigade" force for swift movement to any trouble spot is to remain valid, a more substantial transport force will be needed. In the recent operation, which was one of the largest of its type, about 5,000 troops, with their equipment, were flown to Cyprus between June 14 and 22, by Transport Command Beverleys, Comets and Hastings, assisted once more by Coastal Command Shackletons. As it happened, the time taken for the transfer was not particularly vital, but this may not always be the case.

So far as troop-lifting is concerned, the problem is not critical, since the charter companies may always be relied on for additional transport support, and in fact are reckoned as part of the military airlift potential. Heavy equipment, however, presents a very different problem, since Transport Command has no long-range aircraft capable of lifting bulky items at high speed.

To store heavy equipment at strategic points overseas is obviously not the complete answer, and the position will not be entirely resolved by the arrival of the 20 Bristol Britannia 250s for Transport Command. What the R.A.F. needs are aircraft with the performance, end-loading capacity and freight volume of the Lockheed C-130 and Douglas C-133 of the U.S.A.F.

The Cyprus operation also showed the value, despite their relatively small capacity, of the Comets which in the latter stage of the lift completed three out-and-return sorties compared with the single trips of the piston-engined aircraft. But although Shackletons of Coastal Command made up a substantial proportion of the total capacity, by no means the whole of Transport Command was involved, and its normal trunk route and other commitments were maintained.

In the first part of the airlift, from June 14-19, more than 3,000 troops and 180,000 lb. of freight were transported from Britain to Cyprus. The operation was divided into four phases, the first three covering the transport of the 16th Independent Parachute Brigade, and the fourth that of the 26th Field Regiment.

Phase I involved single sorties by five Beverleys and 15 Hastings, plus two sorties each by three Comets, while in Phase II two Beverleys were joined by 20 Shackletons of Coastal Command. Phase III comprised three Beverleys and 15 Hastings, plus five Comets making 11 sorties. The final lift comprised one Beverley, four Comets and seven Shackletons.

Between June 20 and 22 the airlift was completed by the transport of about 2,000 officers and men of the 1st Guards Brigade, with 45-46,000 lb. of freight. This operation was planned to end in the early hours of June 23, but it finished considerably ahead of time. It was achieved by five Comets, each making three sorties, from No. 216 Sqn., Lyneham; 20 Hastings from squadrons at Lyneham, Colerne and Dishforth; seven Beverleys from Abingdon and Dishforth; and 18 Shackletons and two Hastings Met. Mk. 2s from Coastal Command bases at Aldergrove, Ballykelly, St. Eval and Kinloss.

Average loads for each type comprised 44 troops in the Comets; 45 in the Hastings; 80 in the Beverleys, or 13 and 21,000 lb. of freight; and 31 troops in the Shackletons. The Comets were able to fly the 2,030 nautical miles direct from Lyneham to Cyprus in just under five hours, but the Hastings and Shackletons, also departing from Lyneham, stopped for refuelling at Malta.

The shorter-range Beverleys, operating from Abingdon, made an additional refuelling stop at Orange, in France, before continuing to Malta and Cyprus. The Hastings reached Cyprus in about 12½ hours from the U.K., while the elapsed time for the Beverleys was about 16 hours.

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AUSTRALIAN INTEREST.—The Handley Page Dart Herald was flown recently by Mr. F. G. Shanahan, chief pilot of the Australian Department of Civil Aviation. Left to right, here, are: Sqn. Ldr. H. G. Hazelden, Handley Page's chief test pilot; Mr. Shanahan, Mr. A. M. Letts of the company's sales staff; and Gp. Capt. R. C. M. Collard, the sales manager.

Rolls-Royce In South America

A BRAZILIAN subsidiary company—probably to be located in the Sao Paulo area—is to be formed by Rolls-Royce to provide complete overhaul and spares facilities for the range of the company's engines now going into service in South America. This new Rolls-Royce subsidiary, which will be similar to those in Canada and Australia, will also have modern test-bed facilities and will cater, too, for the users of the company's range of commercial Diesel engines.

Since 1954, business to the tune of £7.5 million — in

(*Continued on page* 882)

Last existing? Above, Mr. V. H. Bellamy's D.H.86.

Right, three tied-together Tiger Moths, and six more, of the Tiger Club.

Below, a Thruxton Jackaroo four-seater at speed.

Above, D. Lockspeiser and Sqn. Ldr. Neville Duke.

R.Ae.S. Family Day at White Waltham

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Above, Mr. J. F. Cuss and son are welcomed by the President and Lady Hall.

Below, Mr. L. F. Nicholson and his family.

Above left, Mr. M. B. Morgan appointed C.B. in the Birthday Honours, with his family.

Above right, G. D. Micklem, J. D. Micklem, Mrs. P. Amagashie, Mrs. J. D. Micklem and Master Micklem.

Below left, Sir Arnold and Lady Hall watch the flying with friends. Below middle, Mr. G. A. Broomfield being received. Below right, Mrs. Brignell, Mrs. Hopkins, Gp. Capt. H. E. Hopkins and Wg. Cdr. J. A. Brignell.

(*Continued from page* 880)

connection with propjets and turbojets for seven airlines—has been done by Rolls-Royce in South America. Even more business is expected by the company in the future as other South American airlines re-equip their fleets with turbine-powered transports. Indeed, as a result of present firm orders, by 1960 Rolls-Royce expect to see nearly 150 of their aero-engines in airline service in South America. It is this growing volume of business which has brought about the formation of the new company and various sites are being considered.

To begin with, the Brazilian organization will provide overhaul and spares service for the Darts in the Viscounts ordered by VASP and the Avons and Conways in the Caravelles and Boeing 707s ordered by VARIG. Rolls-Royce believe that the ready overhaul service thus offered is likely to be of particular interest to the many smaller airlines that are unable to do their own overhauls. It should, they think, also encourage further sales of Rolls-Royce-engined aircraft in a region "where geographical conditions give immense importance to air transport."

One Foot on the Ground

ORGANIZED as part of the International Geophysical Year, the Terre et Cosmos exhibition in Paris has many items of aeronautical interest. Before entering the main exhibition hall one is visually accosted by luridly painted missiles, one of which appears to be aimed directly at the Palais de Chaillôt headquarters of NATO just over the Seine. Among various French research missiles is the shell of an American Vanguard rocket, in finless red and white, next to the planetarium which forms part of the show.

Of the greatest interest is a Sputnik 2 satellite complete with dog-carrying chamber and profuse diagrams. The Russian stand also contains large diagrams of Sputniks 1 and 3, and it is extremely well thought out. In contrast to some exhibition stands seen elsewhere, this display (organized by the U.S.S.R. Academy of Sciences) gives the impression of by no means showing the whole story.

French exhibits include the Monica 5 research rocket, which has taken 15 kg. (33 lb.) of equipment up to 135 km. (84 miles) high and the Veronique liquid-propellent rocket which carries a 60 kg. (132 lb.) payload. By contrast, a nearby diagram records diving depths reached by the bathyscaphe, the greatest depth reached being more than 4,000 m. (13,120 ft.) in 1954.

American exhibits include the head of an Aerobee rocket with transparent plastic covering to reveal the equipment carried; models of Vanguard; photographs of the valiant Col. Stapp on his rocket sledge; a mock-up high-altitude balloon-gondola; and various rocket models.—D.G.

Handley Page Affairs

IN his Chairman's review for 1957, Sir Frederick Handley Page reported a group net profit for his companies of £316,707 less tax. This figure was arrived at after writing off an expenditure of £518,698 incurred in the design and development of the Herald during the year (the total so written off to date under this heading amounts to £2,003,360).

Referring to the Victor and its equipment with the stand-off bomb, Sir Frederick said that the aircraft's outstanding aerodynamic performance had made possible the carrying of more of the latest equipment which had been under simultaneous development by other specialized companies for the Ministry of Supply. This equipment had been issued to Handley Pages for installation in the Victor, but the modifications involved had caused a considerable setback in production and final delivery of the aircraft. "Such a setback," he said, "delays output and leads to increases in the value of work in progress and the finance needed to carry through production." Its effect was seen in the financial results of the year. Victor deliveries were now proceeding according to programme.

After referring to current speculation regarding the future of manned aircraft, Sir Frederick said that his company had decided that it was wise to give emphasis in its future activities to its traditional speciality—large transport aircraft. He revealed that it had offered to the R.A.F. a military version of the jet airliner derived from the Victor. Transport Command was in urgent need of a modern jet-powered long-range freighter and troop transport. Both the airliner and the military transport based on the Victor could be developed comparatively swiftly and cheaply.

Sir Frederick had something to say about "home support" for aircraft that have world-wide operating potential. "If a home government or its national airline has not ordered or sponsored an aeroplane," said Sir Frederick, "it is none too easy to overcome the consequent lack of confidence in that aircraft on the part of possible foreign operators." He was referring to a lack of official support for the Herald feeder-liner, the Dart-powered version of which has already spent more than 125 hours in the air on flight trials since it made its maiden flight on March 11 this year. He stressed the risks inherent in private venture civil aircraft development, and added that the Herald project continued to look so promising that the company had embarked on the tooling up and production of the aircraft.

Extensive research on boundary-layer control systems and techniques continues at Handley Page. And as a long-term project the company, in conjunction with several other British aircraft constructors, is investigating the design of a supersonic civil transport.

Jet Provost on Film

A MOST attractive film on the Jet Provost basic trainer made by Hunting Aircraft, Ltd., was shown recently in London as part of the drive to sell this aeroplane abroad. The Jet Provost has already been demonstrated overseas, and at the time of the film showing was in Peru in the course of demonstration and evaluation in eight South American countries.

In excellent Eastmancolor, taken by "Sammy" Samuelson, the film is well presented, and the good features of the aeroplane are not too persistently rammed home. Its excellent flying qualities are demonstrated, particularly the recovery from a seven-turn spin. This manœuvre was filmed from the cockpit of another Jet Provost flying with the canopy open and limited, because of this, to 180 knots—a most creditable effort.

Simple diagrams show the ease of servicing and maintenance of the airframe and its Armstrong Siddeley Viper turbojet. The film is available with English, Arabic, Spanish, Portuguese or French commentaries. This type of sales-support material is obviously the right way to go about things and should be most useful in sowing the seeds of interest among potential customers.—D.G.

The World Gliding Championships

THE following notes regarding the daily events of the World Gliding Championships in Poland were received as we went to press. Our Gliding Correspondent's account of the proceedings up to the opening ceremony is on page 906.

June 16

Task—out and return 235 km. Weather—brilliantly sunny, blue thermals, strong winds, no cu. until later in day.

June 17

Task—100-km. triangle. Conditions not good—believe there was a strong wind. Haase in HKS round in approx. 80 k.p.h. Deane-Drummond came third.

June 18

Task—goal race to Warsaw, approx. 307 km. Conditions so difficult that none of the 61 competitors reached the goal; task is therefore marked as a distance flight. Deane-Drummond made the best flight of the day, landing some 25 km. from Warsaw (282 km.); Kumpost and Mestan, 259 km.; N. Goodhart came fifth in the Open Class with a flight of 239 km.

June 22

Task—goal race to Ostrow Wielkotolski—93 km. Haase went the farthest, 86.8 k.p.h., closely followed by Komas, 86.1 k.p.h.; N. Goodhart came seventh with a flight of 70.2 k.p.h.; Deane-Drummond, it is reported, went 86 km.

Open Class

Haase first, 3,778; Mestan second, 3,340; N. Goodhart seventh, 3,213; Deane-Drummond ninth, 3,024.

Standard Class

Persson and Witek have now changed their places in the final placings.

Results to date:—

Open Class Totals

Haase, 3,778; Mestan, 3,340; Laur, 3,220; Makula, 3,294; Maxey, 3,245; Komac, 3,222; N. Goodhart, 3,213; Barbera, 3,124; Deane-Drummond, 3,024; Kuntz, 2,947.

Standard Class Totals

Persson, 3,384; Witek, 3,299; Huth, 3,112; Tandefeld, 2,940; Horma, 2,907; Wojnar, 2,185; T. Goodhart, 2,544; Stepanovic, 2,499; Rajn, 2,295; Labar, 2,223; 17th, Wills, 1,531.

EAST AND WEST.—Together for the first time, the Boeing 707 and the Tupolev Tu-104 are here seen at the British Columbia centennial air show at Vancouver on June 15. About 3,000 people were present to greet the Tu-104 when it arrived from Ottawa via Saskatoon. The third production 707 was demonstrated. Two R.A.F. Avro Vulcans attracted much attention.

News of Aircraft, Engines and Missiles

DART POWER.—Most powerful of the Rolls-Royce Dart turboprops, the R.Da.10 has completed a 25-hr. flight-approval test at a military rating of 3,200 s.h.p. for take-off, boosted with water-methanol. Normal rating of the engine is 2,650 s.h.p. Condition on stripping after the A.R.B.-observed test was excellent.

E.P. ENDING. — The Finance Corpn. for Industry has presented a petition for the compulsory winding-up of Edgar Percival Aircraft, Ltd. Since 1954 the Corporation has lent the company more than £300,000. Capt. Edgar Percival, chairman and majority shareholder, has stated that an offer has been received from Samlesbury Engineering, Ltd.

ARROW ORDERS.—Reports from Canada suggest that the Avro Arrow is to be ordered into full production in the autumn. An order for 37 pre-production aircraft has already been placed.

JAPAN'S SUPER TIGERS.—Mitsubishi Heavy Industries is to build nearly all of the 300 Super Tigers for the Japanese Air Self Defence Force. Grumman will produce only a small number of the total. The last aircraft is scheduled to be delivered in 1964.

REGULUS NEWS.—Chance Vought Regulus 2 missiles can be launched by the U.S.S. "Grayback" and "Growler," the last American submarines to be conventionally powered. The U.S.S. "Halibut" will be the first nuclear-powered submarine to have the Regulus 2. One of these missiles was recently fired 300 miles to open the new 500-mile U.S. Navy Inland Missile Test Range.

HELICOPTER HEIGHT.—A new helicopter height record is being claimed for a Sud-Aviation Alouette, which reached 11,015 m. (36,090 ft.) on June 13. The aircraft was piloted by M. Jean Boulet; the height was reached in 35 min. The previous record of 9,076 m. (29,528 ft.) was set up in December last year by a Cessna YH-41.

VULCAN FLIGHT.—An Avro Vulcan of No. 83 Sqn. has flown the 3,345 miles from Ottawa to London in 5 hr. 21 min., an average speed of 625.2 m.p.h. It was piloted by Flt. Lt. G. R. Price. The previous fastest flight over the same route was made in June, 1955, by a Canberra at an average speed of 496.85 m.p.h.

C-133 NEWS.—The Douglas C-133 has been officially named Cargomaster by the U.S.A.F. A new version of the aircraft, the C-133B, has improved Pratt & Whitney T34-9W engines and an increased cargo capacity. Structural differences include the enlargement of the main cargo door to permit easier handling and loading of IRBMs and ICBMs. Gross weight of the aircraft is 286,000 lb. and 15 are on order for the U.S.A.F. It is claimed that the C-133B can carry twice the payload of the largest military transports now in service.

SCIMITAR RECORD.—A new point-to-point record (subject to confirmation), between London and Valletta, Malta, was set up on June 17 by a Vickers-Supermarine Scimitar piloted by Lieut. Cdr. D. F. Robbins. The Scimitar's time for the 1,298-mile flight was 2 hr. 12 min. 27.2 sec., an average speed of 588 m.p.h. The previous record was established in July, 1949, when four Hawker Sea Furies covered the distance in 3 hr. 20 min. 49 sec.

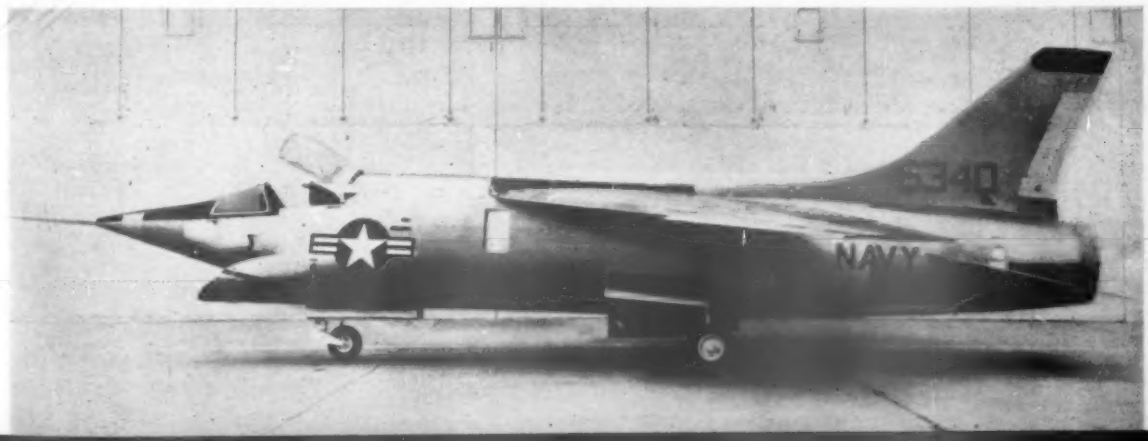
NEXT WEEK

A LARGE part of next week's issue of THE AEROPLANE will be devoted to a survey of the World's Commercial Aircraft. Information will be included on every type of commercial aircraft now in production or projected, together with details of the most important older types still in service.

A particularly valuable feature of this issue will be the presentation of performance and engineering data for each aircraft in a standardized form.

BLOODHOUND ABROAD. — First appearance abroad of the Bristol/Ferranti Bloodhound ramjet-powered surface-to-air guided weapon will be at NATO air displays at Liège, Belgium, and Soesterberg, Holland.

NAVAL FIGHTER.—Latest version of the Chance Vought Crusader is the F8U-3, which has two large ventral fins for improved stability at high supersonic speeds. These fold horizontally for landing. The engine is now a Pratt & Whitney J75 of about 26,000-lb. thrust with afterburning.



Commercial Aviation Affairs

WEST AFRICAN CHANGES.—According to reports last week, the Nigerian Airways Corporation, which will take over the services of W.A.A.C. when this Corporation ceases to exist on September 30 this year (see the issue of June 13, p. 804), is to be 51% Government-owned, with the balance of the capital supplied by the Elder Dempster Group of shipping companies, and B.O.A.C. Nigerian Airways will continue to fly Sierra Leone Airways' domestic services.

TYPE RATINGS.—As from September 15, 1958, aircraft type-rating flying tests for professional licences and for Group C of the P.P.L. will be conducted and certified only by persons approved in writing by the Minister of Transport and Civil Aviation.

K.L.M. TO MOSCOW.—On July 21 K.L.M. will open a weekly service, using DC-6Bs, between Amsterdam and Moscow, via Warsaw. Aeroflot will, starting on the same date, fly Tu-104s on a direct Moscow-Amsterdam service. The frequency will be increased to two a week for the summer of 1959. K.L.M. is to establish an office and a commercial organization in Moscow. The first proving flight by K.L.M. will be made on July 1.

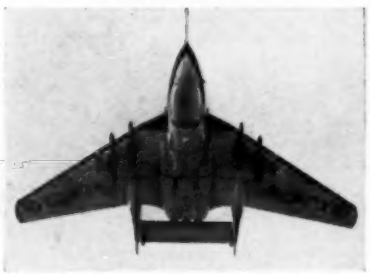
RUSSIAN PRODUCTION.—A new picture of the Il-18 turboprop transport, of which at least three are now flying, one as a freighter. That seen here was on show at Moscow Airport for the recent visit of H.M. The King of Nepal.

NUTTS CORNER INQUIRY.—The public inquiry into the accident to the B.E.A. Viscount 802 (G-AOJA) at Nutts Corner, Belfast, on October 23, 1957, will start at 10.30 hrs. on July 8 at Holborn Town Hall. The inquiry will be held by Mr. J. R. Adams, Q.C., with Sqn. Ldr. B. J. L. Greenland (M.o.S. Blind Landing Experimental Unit) and Capt. S. B. Beevers (Eagle Aviation) as assessors.

ELECTRA DELIVERIES.—According to present plans, 14 Lockheed Electras will have been delivered to operators before the end of this year—12 of them to Eastern Air Lines and two to American Airlines.

BACKWARDS OR FORWARDS.—The evidence in favour of rearward-facing seats is to be considered by a small working group under the chairmanship of Air Chief Marshal Sir Frederick Bowhill, chief aeronautical adviser to the Ministry of Transport and Civil Aviation.

Military Aviation Affairs



MORE ARMAMENT.—The D.H Sea Vixen is now equipped to carry four D.H. Firestreak air-to-air missiles.

JINDIVIK TRIALS.—Following the sale of 10 Jindiviks to Sweden, an R.A.A.F. pilot, Flg. Off. B. J. Avis, has been posted for duty with the R. Swedish A.F. during the trials of the target aircraft. This is the first occasion on which an R.A.A.F officer has been posted for duty in Sweden.

STAVERTON DISPLAY.—At the Air Display at Staverton on June 28, organized by the Cheltenham and Gloucester branches of the R.A.F.A., there is to be participation by both the R.A.F. and the U.S.A.F. as well as by private aircraft. About 20 items make up the programme, which includes aerobatics by Hunters of No. 56 Sqn., four Jet Provosts from the C.F.S., a Vampire and a glider; demonstrations will be given by a Vulcan, Valiant, Hunter, Dove, Varsity, Sycamore, Whirlwind, Gladiator, Chipmunks, Canberras, Javelins and a Boeing KB-50. There are also to be solo and formation parachute drops.

TRANS-AMERICA.—A Boeing KC-135 Stratotanker of the U.S.A.F. has flown from Los Angeles to New York in 3 hr. 42 min. 45 sec. The previous best time for the distance was 3 hr. 44 min., set up in 1955 by an F-84 Thunderjet. The KC-135 is said to have made an average groundspeed of 670 m.p.h.

ISRAELI VAUTOURS.—The Israeli Defence Force/Air Force is to receive six S.O. Vautours.

News About People

AIR TRAINERS' OCCASION.—His Royal Highness The Duke of Edinburgh visited Air Trainers Link, Ltd., at Aylesbury on June 13 and during his tour inspected some of the company's latest simulators and training equipment.

NUCLEAR PRINCESS?—W. T. Peters, chief draughtsman at Saunders-Roe, and two assistants are to go to the U.S.A. to discuss with the U.S. Navy the possibility of adapting a Princess flying-boat as a flying test-bed for atomic propulsion.

GOODYEAR DIRECTOR.—An American, Mr. J. Q. Shaul, has been appointed director of production for the Goodyear Tyre and Rubber Co. (Great Britain), Ltd. He succeeds Mr. H. L. Ginaven and will be responsible for overall production at the Wolverhampton, Glasgow and Wallasey factories.

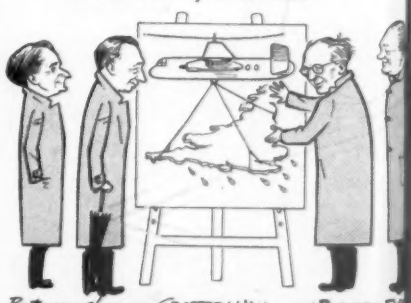
MAJOR ALFORD WILLIAMS.—We regret to record the death of Maj. Alford Williams at the age of 67. He was once chief test pilot for the U.S. Navy and in 1923 he set up a World airspeed record of 266.59 m.p.h. flying a Curtiss Navy Racer. He will be especially remembered for his Grumman Gulfhawk aerobatics. He was a non-starter for the 1929 Schneider Trophy Contest.

A.T.A.F. CHIEF.—Gen. Frank Everest is to command the 4th A.T.A.F. as from July 1. He will continue to be C.-in-C. of the U.S.A.F. in Europe. Gen. Stehlin of the French Air Force is to be deputy commander.

B.O.A.C. APPOINTMENT.—Mr. John Durrant has been appointed district sales manager for B.O.A.C. in Aden. He previously served in Karachi.

LOCKHEED LOSS.—Mr. N. C. A. Spurgeon, deputy managing director of Automotive Products Co., Ltd., Borg and Beck Co., Ltd., and Lockheed Hydraulic Brake Co., Ltd., of Leamington Spa, died suddenly on June 17. He was 55.

Garden Party Interlude



Between showers, GEOFFREY HALL and RICHARD FA... show SIR ARNOLD HALL and DR. ARCHIE BALLANTY... their proposal for transforming this country to the M... Mediterranean for the next R.A.S. Garden Party.

Prototype Wessex

Above, the first all-British Wessex being towed out of the Westland hangar at Yeovil for the first time. The prototype, based on an American airframe, made its maiden flight on May 17 last year.

Above, several intake arrangements were investigated before this production version was decided upon. One of the main problems was to prevent the ingestion of such things as small stones—which is avoided by the plenum-chamber type of intake that has been adopted.

Above, the Napier Gazelle free-turbine engine is neatly housed in the nose of the Wessex. Note the access hatch with built-in servicing platform.

Right, some five months ahead of schedule the first production Westland Wessex was expected to make its first flight earlier this week. Here, preliminary engine runs of the Napier Gazelle shaft turbine engine are under way.

AIR TRANSPORT

The Five-Year A.T.C. Plan

MORE information was made available last week about the plan—to take effect during the next five years—for the modernization of the United Kingdom air traffic control system.

Briefly, this plan assumes the expanded use of surveillance radar—which has for long been the keystone of British concepts of A.T.C.—and long-range equipment will be developed and installed so that, with aircraft at turbine operating altitudes, almost the entire airways system of the U.K. will be under constant scrutiny.

Four new radar stations are to be built at strategic points—two in the south of England, one in the north and one in Scotland. Sites have not finally been agreed and are described by the M.T.C.A. as being in south-east England, in the Manchester area, in the West Country and near Prestwick. However, in the published version of Air Cdre. W. E. G. Mann's Brancker Memorial Lecture last February a diagram of the projected future U.K. radar coverage was shown and this is reproduced here.

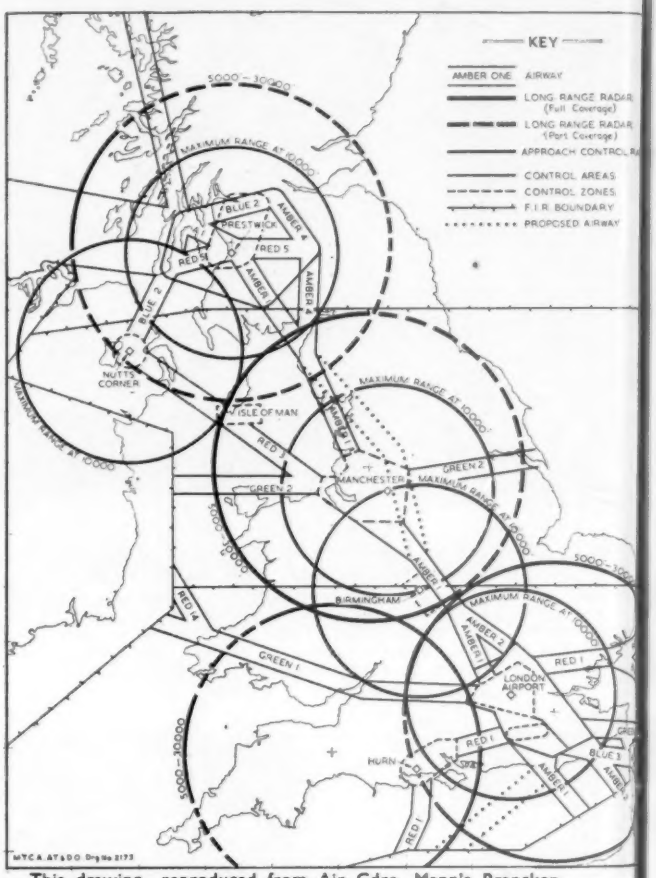
The 30,000-ft. coverage shown on the diagram was almost complete except for the northern areas of Scotland. According to the latest information there will be low-level coverage up to a distance of 85 miles even for small aircraft.

The radar-display information from these four stations will be sent automatically to three joint civil/military A.T.C. centres in London (presumably London Airport), Central England (Preston) and Scotland (Prestwick), and the plan provides for the installation of electronic and other devices for receiving, storing and displaying the information required by the A.T.C. controllers.

Initially the radar information will be displayed directly on conventional PPIs, but these will be progressively replaced by artificial clear-picture displays from which "clutter" and unwanted echoes will have been removed and to which coded information of aircraft identity and heights will be added. The M.T.C.A. Air Traffic Control Experimental Unit is studying this aspect of the problem and the radio industry will be invited to submit plans to meet the requirements.

In parallel with these improvements work is going ahead to introduce semi-automatic control equipment for a number of other tasks—notably the handling of flight plans. The intention is to mechanize (or "electronicize") the entire process of flight-plan handling within the A.T.C. organization in the general interests of safety and efficiency.

Other improvements are contemplated. Plans are in hand, for instance, to provide the M.T.C.A. Air Traffic Control School at Bournemouth (Hurn) Airport, where U.K. and many foreign controllers are trained, with new accommodation and equipment better fitting it for its tasks. There is also a plan to move the A.T.C. Experimental Unit to Hurn, where a new radar simulator, capable of showing artificially the traffic patterns of the future, will be installed to serve both experimental and training purposes.



This drawing—reproduced from Air Cdre. Mann's Brancker Memorial Lecture—gives an idea of the future U.K. radar coverage.

ICAO Sounds a Warning

FOR some time doubts have been expressed about the economic situation of the airlines following the massive re-equipment programme now in progress. Few people, however, have had the temerity to make point-blank statements to the effect that the airlines have over-extended themselves—but now it appears that the International Civil Aviation Organization has sounded quite a loud trump of alarm.

One of the apparently minor decisions made during ICAO's Assembly at Carácas in 1956 was to the effect that—while the Regional Implementation Panel (or "Task Force") and the Jet Operations Requirements Panel were doing their work—the Air Transport Committee should prepare a study of "the economic implications of the introduction into service of long-range jet aircraft."

The results of this study, which was completed last month, are, we understand, both usefully astringent and objective as befits the work of such an international body.

No attempt has been made to offer positive recommendations and the study is necessarily based on a number of theoretical assumptions. One of these is that air traffic will continue to increase at the previous average rate of 15%.

On this very reasonable (and even optimistic) basis, and assuming a fleet attrition rate of 2% per annum, the committee has calculated that there will be an excess of potential capacity (at a 60% load factor) of some 2,100 million ton-miles in 1960 and of about 1,600 ton-miles in the following year. Even if non-scheduled operators buy obsolescent equipment to a maximum extent, the over-production figures are still of the order of 1,500 and 750 million ton-miles for 1960 and 1961 respectively.

Now, obviously, these are no more than theoretical figures—but the important thing is that a responsible body has sounded this and other serious, if gently worded, warnings in a well-documented study.

It might have been expected that there would be over-production during the introductory period of the big turbojets—but this over-production will come at a time when the operators are hard-pressed financially. They will be finding difficulty in disposing of their old equipment at reasonable prices; they will be torn between a wish to raise fares to increase incomes and one to lower them in order to fill the seats in the new aircraft; and they will probably be involved in heavy investments in new accounting and reservations systems. It is interesting to learn, incidentally, that the study suggests, if only by inference, that the fleet-usage problem may only be solved by the introduction of fare differentials by type.

In the meantime a report from the Implementation Panel includes another bitter pill for the operators. Because there is little hope that adequate funds will become available for World navigational-aid improvements, the report considers the airlines to be the only possible source of additional revenue.

America Revisited

News and views about the turboprop and turbojet transports in production in America are given in this article by F. G. SWANBOROUGH, *following a series of visits to manufacturers on the east and west coasts of the U.S.A.*

TO supply the needs of the airlines and the executive market, the U.S. industry has put into production six different types of transport aircraft, three powered by turbojet engines and three by turboprops. With a single exception, each of these types has been introduced as a fully productionized aeroplane from the start and, to finance what is, clearly, the most ambitious programme ever undertaken without direct military support, the industry itself has invested well over $500 million (about £200 million) to date.

A series of visits to the six companies concerned in this effort is impressive on two counts at the present time. In the first place, these companies have made great strides with the physical production of the aircraft in the past 12-15 months (i.e., since the writer was last in the U.S.A.) to the point where deliveries are being made from four of the six production lines. More is said about the individual programmes later in this article.

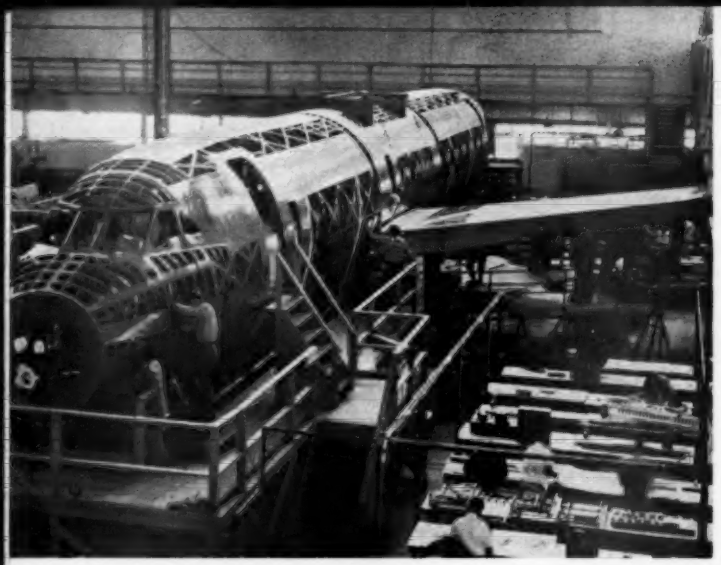
Secondly—and this is of the utmost significance to the British aircraft industry—one is impressed by the almost ruthless vigour with which the sales campaigns for the new aircraft are being conducted. One has to remember that the American businessman is, at heart, among the most ruthless in the World—and $500 million is big business. Also relevant is the fact that, with perhaps one exception, all the U.S. manufacturers are still struggling to reach their break-even points with the new generation transports. Against this background it is to be expected that *no* efforts will be spared to sell—as British manufacturers recently discovered to their cost.

These remarks are not intended to imply that the aircraft concerned are not technically sound or operationally desirable; to underestimate the competition on either score would be foolish, although it is open to doubt whether some of the smaller operators really are well served by a fleet of one or two enormous, ultra-modern turbojets. The lesson which British manufacturers with an eye on World markets still have to learn (there are one or two notable exceptions) is concerned with sales techniques.

Backed by the extensive resources of market research and operational analysis departments using electronic computers, the American salesman sets out today to demonstrate to an airline that its route and traffic pattern is exactly right for whichever aeroplane he happens to be peddling. There is a subtle difference between this approach and one which leaves the airline to determine *what* it wants and then tries to show how a given aeroplane fits this requirement.

This changing approach to the sales problem arises, at least in part, from the complexity of choosing proper operating techniques for the new aircraft—and especially the turbojets. So many variables now come into the picture that the point is being reached where the aircraft's capabilities can be fully realized only by engineers who have lived alongside the project almost from its inception. Hence the increasing desire on the makers' part to conduct their own investigation of an airline's problems in order to relate them to the aircraft's characteristics.

The six aircraft now in production by Boeing, Convair, Douglas, Fairchild, Grumman and Lockheed represent America's first-generation turbojets and turboprops, destined to move the World's airline operations firmly on to A. E. Raymond's next "plateau." Between them, they provide for turbojet operations over ranges of 500-4,000 nautical miles and turboprop operations from 50 to 1,500 nautical miles. This division was not wholly deliberate but, to date, no serious attempt has been made to extend the turbojet down into the short-haul class, while projects for a long-haul turboprop have similarly come to naught. While both these fields are being



METAL MOCK-UP.—While major assemblies for the first Convair 880 are taking shape in the production jigs, this metal mock-up has been put together from production parts and is being used to establish location of wiring, tubing and cables.

watched closely—Douglas still regard a Tyne-engined DC-7 variant as highly promising, for instance, and Boeing have their short-haul Model 727 under constant revision—the biggest prize now set before the manufacturers is in the supersonic transport field.

Supersonic Transports

To the airlines, suffering from dwindling profit margins and a slow-down in traffic growth (which may or may not prove to be permanent) at the very moment of introducing the new turbojets, talk of a supersonic transport must seem especially ill-timed. Most responsible engineers in the industry agree that, for practical airline operation, the supersonic transport is from 10 to 15 years away—and it seems clear that no airline could finance a fleet of such aircraft much before 1970. The decisive factor in timing, however, is likely to be the U.S.A.F. requirement for a supersonic tanker to complement or replace the Boeing KC-135 now in operation with Strategic Air Command.

Provisional requirements for such a tanker have been drawn up within the past year and have given the industry a lead without committing the U.S.A.F. to sponsoring designs or buying prototypes. The "big four" West Coast manufacturers—Boeing, Convair, Douglas and Lockheed—have not been slow to see, however, that here is a chance to repeat Boeing's canny manœuvre which not only secured a major production order for the KC-135 tanker (345 have been bought already, with more orders to follow) but also served to put government money into the development and tooling of the commercial 707. The company which can obtain U.S.A.F. contracts for the supersonic tanker is going to be in the best position to supply the airlines with supersonic transports when (and if) the time comes.

Although Boeing and Douglas will have the massive weight of 707 and DC-8 experience behind them, Lockheed and Convair seem to be most favourably placed in the supersonic bidding. Convair have produced the largest supersonic aeroplane to date, in the B-58 Hustler, and have probably amassed more supersonic time than any other manufacturer, with the help of the B-58, F-102 and F-106. Lockheed also have extensive knowledge of high-speed, high-altitude flight through the F-104 and they also have the advantage of a claimed "break-through" in the design of a supersonic transport.

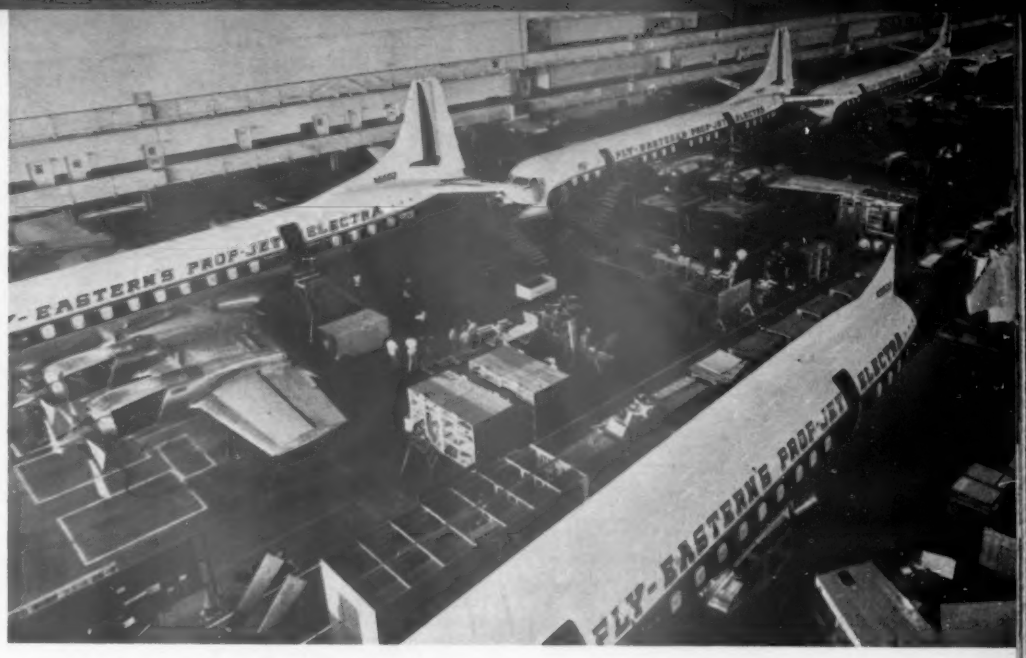
This "break-through," which is probably an aerodynamic one, would make it possible, Lockheed claim, to have the prototype of a practicable supersonic vehicle in the air in three years if construction started now. No details have been given, but if the claim is true, it must be assumed that Lockheed can see some way of keeping the direct operating costs down to roughly today's level—or about half of those estimated by other manufacturers for their supersonic studies. All seem to be agreed that a cruising speed of Mach 2-2.5 will be adopted.

The Turbojet Trio

The first generation turbojets are, of course, all firmly subsonic—and much more so than one might suppose from the publicity "blurbs" which now speak of the "600-m.p.h. DC-8" and credit the Convair 880 with a cruising speed of 615 m.p.h. Figures such as these are totally unrealistic so far as airline operations are concerned: for best range, the DC-8 would probably return a mean speed of not more than 550 m.p.h. and the Convair 880 would not be much faster. Publication of inflated performance claims is still, incidentally, a characteristic of American publicity departments which seems hard to justify: the airlines will certainly not make their purchases on the basis of these figures and the travelling public are likely to be disappointed when they find they are flying at less than the speeds they have been led to expect.

Boeing, still consolidating the advantages which derive from their original and successful bid to obtain military backing, are smoothly stepping up production of the 707 as the certification programme proceeds. By the end of May, they had flown the first three production 707-120s (all for Pan American) and these three aircraft had between them completed 320 hours. In addition, the old "dash-80" prototype had flown for more than 930 hours and is still being used for special trials in the C.A.A. programme, including engine icing tests now in progress. On present showing, the target date for completion of certification flying, July 18, is likely to be bettered and the -120 will most probably be in service with Pan American on the North

MEET THE FAMILY.—Prior to making its first flight, the Douglas DC-8 posed with other members of the Douglas family — reading upwards are a DC-3, DC-4, a military DC-6 and a DC-7.



GOLDEN FALCONS.—Six Lockheed Electras for Eastern Air Lines are seen on the final assembly line at Burbank. Eastern will be the first to use Electras, with the fleet name Golden Falcon.

Atlantic by the end of November. Before that date, Pan American may operate 707s on an experimental freight service from New York to Puerto Rico, to build up operating experience.

Douglas, meanwhile, began flight trials with the DC-8 at the end of May and, whilst extending every effort to keep to their certification and production programme, are no doubt thankful in some respects that Boeing are setting the pace—and solving some of the problems. By the time the DC-8 has been certificated, in October, 1959, over 30 aircraft will have been delivered from the Long Beach factory, and most of these will be ready for service in late 1959 or early 1960 with the airlines which will have been completing crew training and route proving prior to certification.

Both Boeing and Douglas are planning to increase the weights of their transports, although for slightly different reasons. As at present planned, the 707 will fly farther than the DC-8, but the latter will carry a bigger payload for a given range. Boeing, therefore, want to put up the gross weight without significant alteration to the basic operational empty weight in order to gain more payload—and flight trials to date suggest that this can be done without impairing the guaranteed performance.

Douglas, on the other hand, need more range to match the 707-320 and -420, and this is being obtained by increasing the fuel capacity by nearly 1,500 Imp. gallons. The gross weight then goes up by 22,500 lb. to 310,000 lb.—making this the heaviest commercial aircraft so far announced apart from Russia's Tu-114. These very high gross weights—the 707 is also likely to be over 300,000 lb.—rely on considerable increases in the power of the Pratt & Whitney JT-4A and Rolls-Royce Conway used by both types of aircraft.

Convair, with the 880, are in a less satisfactory position than Boeing and Douglas, with firm commitments for 40 aircraft and with possible orders for another 20 or so subject to confirmation. Since the first-round buying of the big turbojets (i.e., the DC-8 and 707) is almost over, the Convair 880 is potentially a better seller at the present time. It is, however, facing growing competition from the Boeing 720 and the Douglas DC-9 medium-haul jets in one direction and has failed to compete effectively with the Electra in another.

Convair embarked upon assembly operations on the 880 in the spring of this year, and expect to fly the first aircraft next January. Like all the American manufacturers, this company has moved straight into production and will use customers' aeroplanes for certification trials. Certification target date is March, 1960, and the present plan is to produce six a month by July of that year. The production line has been laid out to build up to 12 a month.

For specific prospective customers, Convair have been looking at heavier and bigger versions of the 880. In some studies, the gross weight has grown from the present 178,500 lb. to more than 200,000 lb., together with an increase in wing area, from 2,000 to 2,350 sq. ft., and in fuel capacity.

EXECUTIVE OFFICE.—The flight deck of the Grumman Gulfstream in mock-up form shows a typical American layout. The visibility from the cockpit is especially good.

The Turboprop Trio

On the West Coast, Lockheed are in a minority of one with their turboprop Electra. By all accounts, the Electra has been going extremely well since its first flight last December. Already, five are in the air and up to the beginning of June the first four had amassed 420 hours, including 180 hours each by the first and second aircraft (the latter flew on February 13).

Lockheed have gone flat out for fast production, although production considerations were never allowed to influence the choice of "optimum structure" in the basic design. As a result, the company can offer new customers very rapid delivery—at peak production, time from cutting metal to roll out will be 60 days, the company claim—but they pay the price in high tooling costs. This is reflected in the high break-even point, perhaps as many as 400 aircraft, necessary to keep the unit cost down to a reasonable level.

Lockheed remain outwardly optimistic that they will sell 400 Electras commercially, but their sales "pitch" has recently

FAIRCHILD'S FIRST.—The first Fairchild-built F-27 on one of its early flights. Two more F-27s have now flown and the first delivery to a customer, West Coast Airlines, was made earlier this week.

been amended to emphasize the Electra's attractions on ranges up to about 700 miles—it being conceded that above that range existing or projected turbojets are at least directly competitive. This, be it remembered, is with an aeroplane which, in its early design life, was stretched to have a range of over 2,000 miles instead of the 1,000 miles at first planned.

There is little doubt that Lockheed would like, today, to be in the jet market, but it is now too late to offer an aeroplane in the medium-to-long-haul class and a shorter-range jet would compete with the Electra. As a result of the U.S. Navy's intention of buying an A.S.W. version of the Electra to replace the Neptune, however, there is no longer any doubt that the type will make a profit for the company and every attention is therefore now being given to the supersonic field.

With the F-27, Fairchild are in a very strong position to meet the requirements of local service operators and small airlines overseas, as well as the feeder-liner needs of larger operators. Having flown their first F-27 in April and the second in May, Fairchild planned to deliver No. 3 to West Coast Airlines on June 22, with a view to the type being in service in the late summer. The F-27 already has a C.A.A.-type certificate—obtained by Fokker with their two prototypes—and Fairchild have only to clear the various design changes they have made. They will also be responsible for certification of the version with the bigger Dart R.Da. 7/1s.

To meet present commercial orders for the F-27, Fairchild have planned a production rate of four-five aircraft a month, but this could be doubled without difficulty; and will be so if prospective U.S.A.F. orders for up to 200 F-27s materialize. Even apart from military and Naval orders, Fairchild have estimated a potential market for as many as 1,000 F-27s over the next 10 years.

With the Gulfstream, Grumman are aiming exclusively at the executive market, although this aircraft might also have some specialized application as a feeder-liner in some places. The Gulfstream is interesting as the first executive aeroplane put into production from scratch for this market, and interest in it already shows signs of justifying Grumman's investment.

The first Gulfstream is now in final assembly and will fly in July or August. It and the next aircraft off the line are to be used in the certification trials, which are expected to be completed in May of next year. Grumman's investment in the programme covers the tooling and production of five aeroplanes; beyond the fifth aircraft, metal will not be cut until firm orders have been obtained. So far, provisional deposits have been paid on about 20 aircraft.

Powerplants

The development of powerplants is hardly less important than of the airframes themselves. It is worth recording that of the six types of aircraft discussed here, two are in production exclusively with the Rolls-Royce Dart; two are offered in variants (both ordered) powered by the Rolls-Royce Conway; and the other two have been studied with, respectively, the Rolls-Royce Tyne and Rolls-Royce Avon. The British company has reason to be proud not only of its success in selling its products in the U.S.A., but also of the reputation it enjoys—as we discovered—for a fine product and fine service.

Rated at 13,000 lb.s.t. (with water injection) for take-off, the Pratt and Whitney JT-3C-6 is the most powerful commercially approved turbojet to date. Under development, the JT-3C-7 will produce 12,000 lb. (dry) and is about 750 lb. lighter than the -6.

Three other turbojets, all in the flight-test stage at present and destined for commercial use, are the General Electric CJ-805, the Pratt & Whitney JT-4A and the Rolls-Royce Conway. Since these are all military engines, precise performance data are not available, but a study of the characteristics of the aircraft they power leaves little doubt about their ratings.

The CJ-805-3, to be used in the Convair 880, will produce between 10,500 and 11,000 lb.s.t. The JT-4A-3, which is the first commercial version of the Pratt & Whitney J75, will give 16,500-17,000 lb. (without water injection) and the JT-4A-9 for the later DC-8s and Boeing 707s seems likely to produce around 19,000 lb.s.t. Published thrust of the Conway R.Co.10, which is to be used in the 707 and DC-8, is 16,500 lb.s.t., but military Conways have already been type-tested at 17,250 lb. and the R.Co.12 will match the JT-4A-9 in performance.

Of much interest to the airlines at present are the Pratt & Whitney and General Electric turbo-fan (by-pass) engines—respectively the JT-3D and CJ-805-21. Both these engines offer a thrust improvement of some 30%, bringing them respectively into the 17,000 lb. and 14,000 lb. thrust classes, while the specific fuel consumption is reduced by 7-10%.

At the lower end of the thrust bracket the American manufacturers still have comparatively little to offer, and this fact, as much as anything, has retarded the development of a short-haul turbojet. Most promising now is the 7,500 lb.s.t. Pratt & Whitney JT-8 (in production for the U.S. Navy as the J52) which Douglas will probably use in the DC-9. Pratt & Whitney have also begun development, as a private venture, of the 2,500 lb.s.t. JT-12. Under licence from Bristol, Curtiss-Wright offer the Orpheus as the TJ-37 and there is a good chance that this will go into production for the Jetstar, in the two prototypes of which it has performed outstandingly well.

Among the turboprops, the Allison 501 is certificated at 3,750 e.h.p. and the 501D-22 will give more than 4,000 e.h.p. at take-off. In the same power bracket as the Dart, the General Electric T58 has not been adopted for commercial use, but has been considered in design studies from time to time. Some of the smaller turboprops might also come into the commercial picture eventually, but most emphasis is being put upon turbojet development in all power brackets.

SIGNIFICANT SEXTET

Aircraft	Powerplant	Gross weight lb.	Dates First flight / First service	Total on order	Approx. break-even	Peak monthly production	Unit cost
DC-8	JT-3C JT-4A Conway	310,000	30/5/58 Oct., 1959	138	160	10	$5.5m.
Boeing 707	JT-3C JT-4A Conway	295,000	20/12/57 Nov., 1958	167	—	10	$5.5m.
Convair 880	CJ-805-3	178,500	30/1/59 March, 1960	48	150	6	$3.5m.
Electra	501D-13	113,000	6/12/57 Sept., 1958	151	400	10‡	$2.2m.
F-27	Dart	35,700	12/4/58 Sept., 1958	72	200	5	$590,000†
Gulfstream	Dart	31,000	July, 1958 May, 1959	20*	—	3-5	$700,000‡

* Firm options. † Basic airliner less radio. ‡ Bare airframe less electronics and furnishing.

Victory Without War

by Air Marshal Sir Robert Saundby

SINCE a world conflict will never be initiated by the Western Powers, it will come—if it ever does come—as a result of a deliberate decision by the Communist rulers of Russia and China. They will, broadly speaking, have a choice of two methods. They can either make a sudden all-out attack with long-range nuclear weapons, hoping at one blow to destroy the power of retaliation of the West, or they can rely on their vast preponderance in conventional forces, and renounce the use of all nuclear weapons while calling upon the West, probably in the name of humanity, to do the same.

The second method is, to my mind, by far the more likely of the two, and it is also the more difficult to deal with. It would put upon the Western Governments the responsibility for starting a full-scale nuclear contest that might destroy half the world.

In America, however, there seems to be a good deal of anxiety about the first method. This is probably a legacy of the appalling shock administered by the devastating Japanese attack, without warning, on Pearl Harbour, in December, 1941; a disaster which caused acute personal distress to every American citizen. But whatever the reason, there is widespread uneasiness in the United States about the possibility of their being disarmed by a sudden surprise attack. Many Americans believe, as Mr. George Fielding Eliot says in his book "Victory without War, 1958-1961"* that "what the Soviets mean to do is to wait until they can be sure they can destroy all our retaliatory power at one blow."

Mr. Eliot regards it as axiomatic that the Soviet rulers would strike the United States with nuclear weapons if they believed that they could, in one surprise attack, destroy all the air bases or missile bases from which a counter-attack could be staged. But he insists that the Soviet leaders dare not accept any risk of nuclear retaliation against the vital centres of the Soviet Union. No relative factor of safety, based on percentages and probabilities, would be acceptable to them, because "their power, their authority, their very lives could well be forfeited by the explosion even of a moderate number of hostile nuclear weapons in the Soviet heartland."

This is almost certainly true, and it is on that assessment that our faith in the nuclear deterrent chiefly rests.

But it rests also on the assumption that it is not within the power of the Soviet Union to destroy, at one blow, the whole of our retaliatory power.

Mr. Eliot challenges this assumption. He agrees that, at present, when the only possible attack on American air bases could come from manned long-range bomber aircraft, there would be sufficient warning for many, if not most, of the bombers to take-off. The distances involved, the relatively slow speed of near-sonic bombers, the efficacy of the early-warning system, and the high degree of readiness maintained by the Western strategic bomber forces, all combine to make it most unlikely that the Communists could destroy, or even seriously cripple, our power of retaliation.

But when the Russian-manned bombers are replaced by long-range ballistic rockets with nuclear warheads, there will be very little warning, and it might be possible for the Soviets to destroy, practically simultaneously, every Western air base. They might be prepared to accept the risk, if all our retaliatory power were in manned aircraft, that some bombers might be armed and airborne at the moment of the attack. For they would know just how long it would take such surviving aircraft to reach the Soviet vital centres, and they could concentrate all their defences against them. Even if a few got through and dropped their bombs, the Soviet leaders would know—and would be able to guarantee to their people—that there would be no further attacks, as no U.S. or Allied bases would be available for refuelling and re-arming such aircraft as were able to return.

Since it appears to be generally agreed that Russia has concentrated on the production of the long-range nuclear rocket missile, and is considerably ahead of the United States in this development, Mr. Eliot foresees that in 1961 or thereabouts, the Soviet leaders might be in a position to destroy, in one surprise attack, all the NATO air and missile bases in the United States, Canada, and Europe, and all the American bases in the Near and Far East.

Defence against such an attack can be found only in mobility and concealment. Air bases are immobile and it is impossible in democratic countries, to keep secret their location. They are very difficult to conceal, and in any case concealment is ineffective against a long-range missile pre-set to strike a known geographical point.

The answer to this problem, Mr. Eliot believes, is to be found by basing a part of the counter-attack in vessels moving on or under the surface of the sea. The United States has, at present, aircraft carriers capable of operating bombers carrying nuclear weapons at ranges of up to 1,500 miles from the carrier's deck. By 1959, he states that it will be possible to operate atmospheric missiles of the Snark type, with super-sonic speeds, from carriers, submarines, and cruisers.

During 1960, the American Navy's ballistic missile Polaris will become available. This weapon, which has a range of 1,500 miles and a nuclear warhead, can be launched from surface ships or nuclear-powered submarines. Mr. Eliot estimates that several such submarines would be available in 1960, and perhaps as many as 20 by 1961.

If, therefore, the United States were to decide now to give priority to this programme, it would be possible to have, by 1961, the year when it is calculated that the Russians would be in a position to destroy all the Western air or missile bases by a surprise long-range missile attack, a sea-based retaliatory power which would be able to strike at the vital centres of the Soviet Union.

Mr. Eliot contends that these sea-borne bases, being mobile, would be virtually immune from surprise attack by Soviet ballistic missiles. Since, therefore, the Russians could not count on being able to knock out the whole of the Western power of retaliation, they would not dare to risk the attempt. He believes that even if 10% of the nuclear counter-attack were sea-borne it would almost certainly have a decisive deterrent effect, and that if 20% could be so deployed the Russians would regard the risk as completely prohibitive.

Mr. Eliot emphasizes the need for a decision now, to give the requisite priority to this transfer of some of the U.S. retaliatory power to sea-borne bases, so that it may be ready to provide a deterrent in the dangerous year of 1961.

It cannot be denied that this danger may arise within the next few years, and that there is a possibility that the Soviet rulers, believing that they have an opportunity—which will never recur—of destroying the nuclear strength of the Free World, might be tempted to stake everything on a surprise attack with long-range ballistic weapons. It is a risk which we cannot ignore, and the development of a substantial degree of sea-based retaliatory power would undoubtedly gravely complicate the Russians' task, and might indeed tip the scale against a decision to invoke full-scale war. To that extent,

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therefore, sea-borne nuclear capacity will strengthen the deterrent, and would be worth while.

Mr. Eliot cites an additional argument in favour of sea-borne retaliatory power. He points out, with much truth, that Soviet propaganda has been greatly concerned to frighten America's Allies by threatening, in the event of war, to pulverize air and missile bases set up on their territory, with all the appalling consequences of such an attack. The Communists hope to stir up among the faint-hearted, the short-sighted, and those who feel rather than think, a strong opposition to the building of NATO missile bases in European countries. They hope that these people, combining with those who from religious or pacifist convictions oppose all nuclear weapons, will be able to build up a powerful body of opinion opposed to the proper organization of modern defence in the Free World.

Advantage of Sea-based Nuclear Capacity

In this policy they have had a good deal of success, and Mr. Eliot fears that it may become increasingly difficult for the United States to maintain its bases in Allied countries. In addition, such countries may insist on retaining a power of veto over the use of bases in their territory, and thus at a critical moment it might prove impossible to make use of them. By contrast, sea-based nuclear capacity is physically detached from populated areas, and attempts to destroy it would consequently have little or no disastrous effects on Allied countries.

This is true, and it certainly adds weight to the arguments in favour of basing some part of the nuclear deterrent on the sea.

If Mr. Eliot had been content to leave the matter there, it would have been difficult to disagree with his conclusions. But he goes much further. While minimizing the difficulties of destroying simultaneously several hundred land bases scattered over half the World, he seeks to prove that aircraft and missile carriers operating on the surface of the sea are virtually undetectable and unsinkable. He glosses over the principal defect of ships in the missile age—their extremely slow speed and the consequent delay, which may well be measured in days, in moving them to a position from which they can operate effectively.

In assessing the deterrent value of large surface vessels used as launching sites for aircraft or missiles, we must remember that the whereabouts of such ships in peace-time is generally fairly well known. It is difficult, in times of peace, to keep such ships at sea, with wireless silence, in unknown positions within range of Soviet vital centres. During the last War we were hardly ever unaware of the location of the German warships. The Russians, therefore, might be able to choose a moment when most of the carriers, or even all of them, were unfavourably placed for immediate counter-attack.

Even if aircraft carriers could be maintained, at any given moment, in positions unknown to the Russians from which they could operate effectively, the launching of an attack by aircraft would very soon give away their approximate position. Even if they were not found earlier, the returning aircraft could be followed home and the ships attacked in force at a time when it was imperatively necessary for their aircraft to land-on. All ships at sea are extremely vulnerable to attack by air-to-surface rocket missiles launched from aircraft, and carriers are particularly inflammable.

A Tragically Optimistic Estimate

In spite of a long series of disappointing experiences, carrier enthusiasts still persist in believing that, unlike all their predecessors, the present generation of ships are practically proof against attack by torpedoes, rockets and bombs. Mr. Eliot even states that a near miss with a nuclear weapon would not necessarily be fatal, as " the tremendous strength of the carrier's hull and frame offers great resistance to blast." He also asserts that, owing to subdivision of the hull into many watertight compartments, something like 12 torpedo hits are required to sink a modern carrier.

His assertion recalls the insistence of the Admiralty before the last War that six torpedo hits would do no more than slow our latest battleships' speed by three knots. This estimate proved to be tragically optimistic. And we are told, as we were before the last War, that a wonderful new secret system of anti-aircraft weapons will soon give comparative immunity from air attack.

We have heard all this often before, and it has always proved to be mistaken. It is impossible to believe it. The carrier might escape observation for long enough to get into position and launch its counter-attack, at present by means of aircraft but later reinforced by medium-range ballistic missiles. And it might last long enough to carry out some subsequent attacks. But when found and attacked it is vulnerable, and it would be folly to count on its survival.

There is no need, however, to prove that the carrier is unsinkable in order to make a case for it. The uncertainty of being able to find and deal with them before they could launch a counter-attack would in itself enable the carriers to make a substantial contribution to the deterrent.

The next stage in the development, nuclear-powered carriers and especially submarines capable of firing medium-range ballistic weapons with nuclear war-heads, promises to provide the deterrent with a real accession of strength. The nuclear-powered surface ship equipped to launch Polaris missiles or their successors would enjoy considerable advantages over the aircraft carrier as we know it today. It would have much better sea-keeping qualities, being relieved of the need for frequent refuelling, and it would therefore be easier to conceal its whereabouts. As soon as it had launched its missiles it could withdraw at top speed, and it would not be possible to locate it by following its returning aircraft. It would be less inflammable, as it would not have to carry large quantities of oil fuel for its own engines and for its aircraft.

The main drawback of the carrier, however, would remain, for it is unlikely that nuclear-powered ships will show any marked increase of speed, though they can maintain their full designed speed without a corresponding loss of endurance. But even if that speed could be raised to 40 knots, it would take a carrier 24 hours to travel 1,000 miles, against 1½ hours by a near-sonic bomber and a couple of minutes or so by a rocket missile.

The Submarine under Air Force Control

But it seems probable that, when the rocket missile replaces the manned bomber as the principal method of delivering the counter-attack, the nuclear-powered submarine will replace the surface ship as the mobile base. The submarine of the future, armed with medium-range rocket missiles which can be launched while submerged, will be able to exploit to an exceptional degree its defensive principles of mobility and concealment. It is true that its mobility will be limited in time by its relatively slow speed, but almost all the seas and oceans of the World will be open to it. Its powers of concealment will be very great, even after making allowance for the probable improvements in radar and other methods of detecting submerged vessels. It will carry enough fuel to enable it to cruise at sea for a year or more, and it should not be difficult, when sufficient such submarines are available, to ensure that a number are always at sea within striking range of their objectives.

Until the anti-missile is perfected, no effective defence against this form of nuclear counter-attack will be possible, and its deterrent value will be great.

It remains only to point out that this development has nothing to do with the exercise of sea power, the object of which—as Mr. Eliot agrees—is "to control the sea as a means of transportation, to use it freely for one's own purposes and to deny it to the enemy." The use of nuclear-powered submarines as launching bases for rocket missiles, aimed at the vital centres of the enemy, is an extension of our system of bases for the nuclear counter-offensive from the land to the seas and oceans of the World. By doing so we can increase its effectiveness and reduce its vulnerability, and thus reinforce its deterrent value. But the whole armoury of nuclear ballistic missiles, whether based on land or sea, must be centrally controlled and directed, which means in practice that the sea-based nuclear weapon system must be under the operational control of the Air Force, which will be responsible for the conduct of the nuclear counter-offensive.

Mr. Eliot has written a forceful, vigorous, well-argued, and persuasive book, which, although it would have been more effective if it had not over-stated the case for sea-borne nuclear capacity, is certain to have a considerable influence on American public opinion and, indeed, on opinion in all NATO countries. It will have a special interest for those Powers which aspire to contribute to the nuclear deterrent and have a Naval tradition.

Armstrong Siddeley at Ansty

Photographs copyright "The Aeroplane"

This handsome main office block and front hall for Armstrong Siddeley's engineering centre at Ansty was completed and occupied by the middle of 1957. In this building, too, are housed the technical and development engineers.

DESIGN, research and development facilities now provided within the boundaries of Armstrong Siddeley's new engineering centre at Ansty—about 7 miles eastward from the centre of Coventry—represent resources that ensure that the company is adequately equipped to deal with any demands likely to be made in the foreseeable future. This was how the company's managing director, Mr. H. T. Chapman, C.B.E., M.I.Mech.E., F.R.Ae.S., described the Ansty establishment when the Minister of Supply paid it a formal visit at the end of January, this year.

This major component of the Armstrong Siddeley organization is located on a 300-acre site and includes a most attractive main block housing the technical, development and experimental teams. There is an extensive collection of turbine engine test-beds, a separate rocket engine test site, and a number of special workshops and laboratories. Our purpose here is to show some of these activities and to describe how they have come into being.

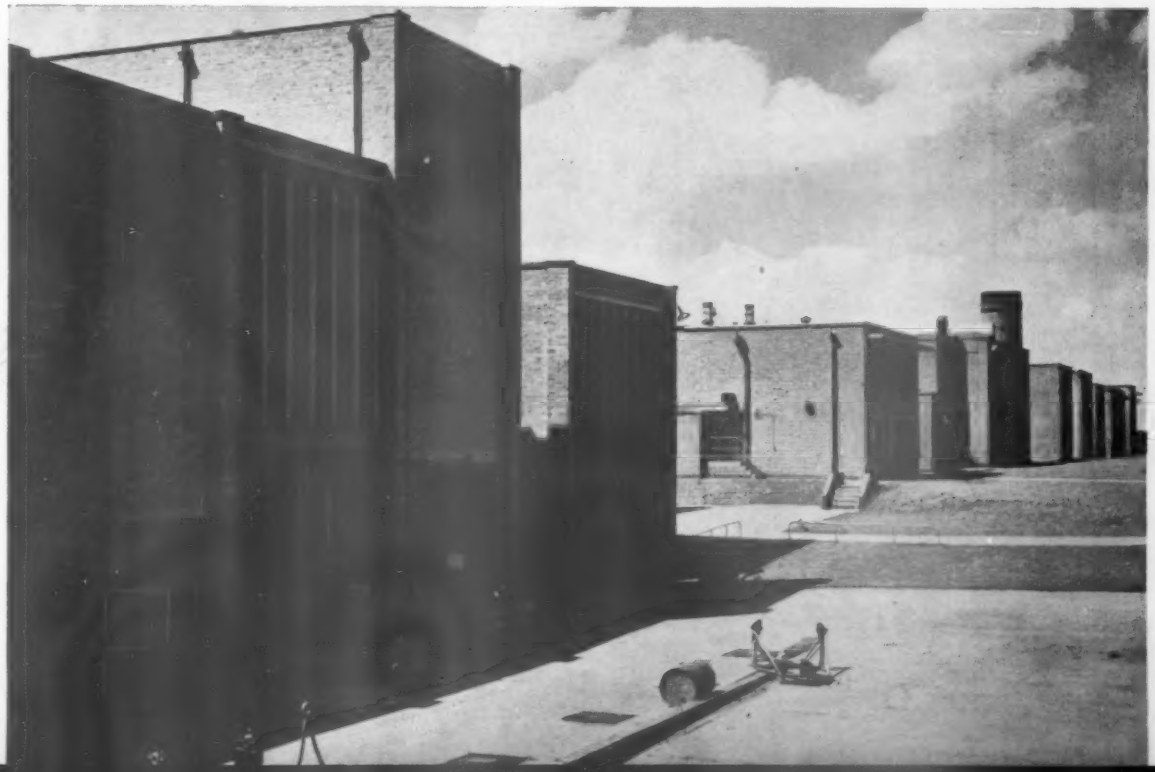
The history of Armstrong Siddeley's new engineering centre at Ansty really dates back to 1935, when Sir John Siddeley (later to become Lord Kenilworth) bought the site there. It was intended as an aerodrome from which Air Service Training would operate their pilot training scheme. In this role Ansty was used until 1940-41, when Service training was absorbed into the Empire Training Scheme. The then Ministry of Aircraft Production took over the aerodrome and, as part of the wartime "shadow" production scheme, handed it on to the Standard Motor Co. for the production of Oxfords and Mosquitos.

At the end of the War, this production work having ceased, Ansty became an M.o.S. equipment store for a while. Soon afterwards, however, when Armstrong Siddeley's turbojet and turboprop projects began to develop, the company's test facilities at Parkside in Coventry were gradually becoming too cramped, and additional testing capacity was sought. Ansty was considered to be a useful location for such activities and steps were taken for Armstrong Siddeley to expand in that direction. At that time, though, the company did not need the whole of the available space at the aerodrome and A.S.T. again set up a Service flying training school there. This stayed at Ansty from 1951 to 1953, during which time Armstrong Siddeley were gradually expanding into the site and taking over buildings as they became available.

One of the first "moves" was that the existing flight sheds were pulled down to provide room for the test-beds construction of which began in 1945. The first of these was an open-type of bed for propeller testing on the Python. In this the 4,000-h.p. turboprop engine complete with its counter-rotating airscrew was carried on a dummy wing mounted from a girder structure. This somewhat crude installation was later supplemented by more refined enclosed and silenced beds to be used for Python development.

The second step in the development of the test site was the building of two enclosed beds for the single Mamba turboprop engine intended for the A.W.A. Apollo and Handley Page Marathon civil transports and later the Short Seamew Fleet

(*Continued on page* 896)



A general view of some of the turbine-engine test-beds on the main test site at Ansty.

Ansty Activity

Interior views of Armstrong Siddeley's new engineering centre

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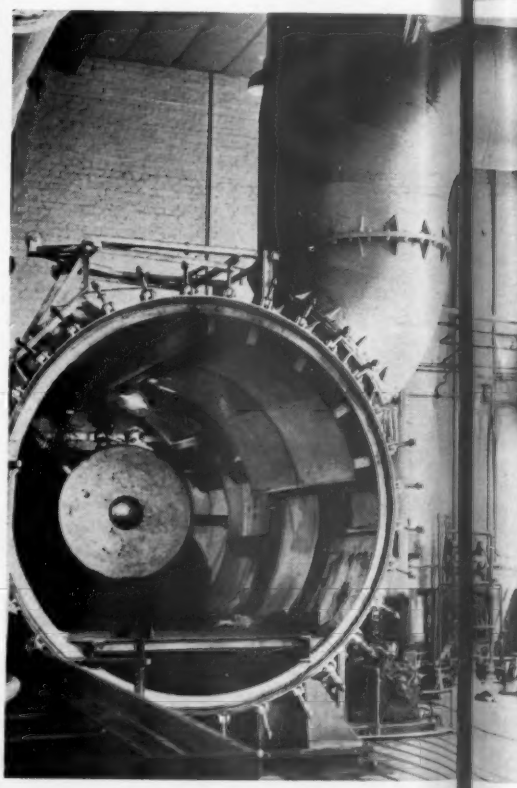
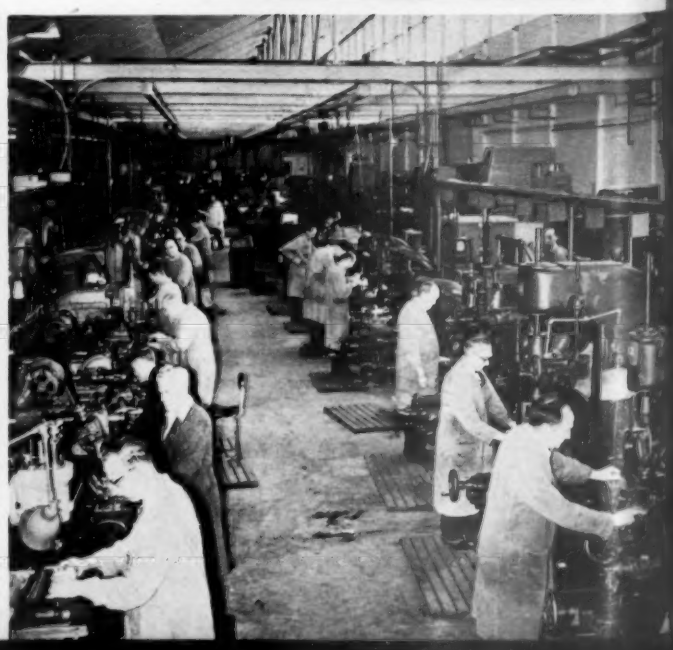
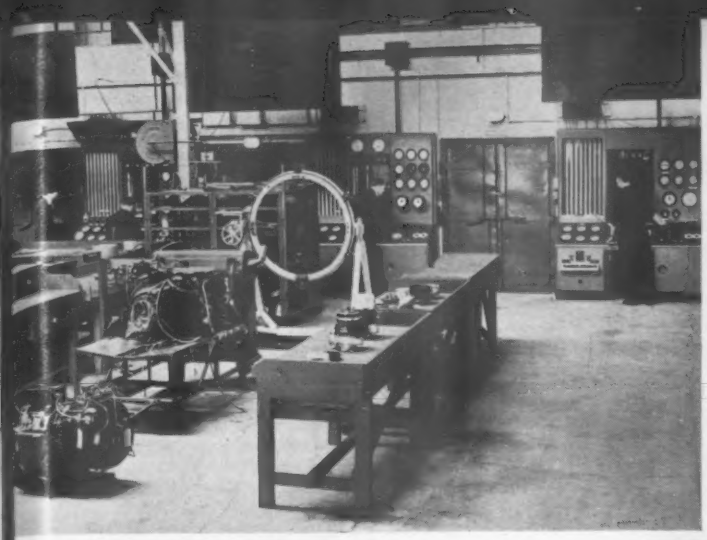
Above, a section of the Sapphire overhaul shop where Javelin engines are at present being overhauled for the R.A.F. under Air Ministry contract.



Left, instruction on the detail points of Sapphire servicing being given in the company's comprehensive Service Training School at Ansty.

Below left, part of the main erection shop where all the Armstrong Siddeley turbojet and turboprop development engines are now assembled.





Above, the small-engines laboratory, which is equipped with eight test-beds, two of which can be seen along the far wall; in the left foreground is an AiResearch A.P.U.

Above right, the machine section of the Apprentice School, which is also located at Ansty.

Above, a corner of the very fine main drawing office, which covers all aspects of Armstrong Siddeley's work on aero-engines and Diesel engines.

Above, in this compressor/turbine test house, which has an available shaft horse-power of 10,000, the complete performance characteristics of aero-engine compressors and turbines can be established.

Left, a section of the large machine shop which is very well equipped with a wide range of machine tools.

Right, No. 4 shop, with an area of 100,000 sq. ft., is one of the newer buildings at Ansty and, in addition to housing the development machine shop, also contains the sheet metal section, part of which is seen here.

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spotter for the Royal Navy. These beds have now been pulled down and have been replaced by a pair of Viper turbojet beds.

In 1948-49 when Armstrong Siddeley took over the Metropolitan-Vickers turbojet and began to develop it into what was to become the Sapphire, four separate test-beds were built at Ansty specially for this work. Round about this time, too, work was started on a special compressor/turbine test chamber to which 10,000 shaft horse-power was delivered from a Hunt-class destroyer powerplant.

The next expansion at Ansty was the building of a pair of test cells for the general development and production running of Double Mamba engines. Later, when more test capacity was needed, three more Double Mamba beds were built and a dynamometer-type test-bed for Double Mamba work installed.

When reheat engines came into the picture, a special reheat Sapphire test cell was built at the end of the row. And later, when additional facilities of this sort were needed, one of the three normal Sapphire beds was modified to have the greater intake area required for a reheat engine and to incorporate the latest Cullum Detuners in order to reduce the exhaust noise from the test-bed to a minimum.

Altogether, then, there are at present no less than 15 test-beds on the turbine-engine site at Ansty. To summarize, these comprise: the open Python bed, which is now used for general starter development; the enclosed Python hangar-type test-bed; two Viper beds; five Double Mamba beds; two normal Sapphire beds; two reheat Sapphire beds; and a 10,000 h.p. compressor/turbine test house.

Smaller test-beds—eight in number—are available in a separate building, known as the small-engine laboratory. Here the development of civil general-purpose engines and such units as the company's well-known range of commercial Diesel engines is carried on. In this laboratory, too, the AiResearch auxiliary power unit, for which Armstrong Siddeley have a licence, is being developed.

More or less parallel with the development of the turbine engine test site, there has been a gradual expansion of the other facilities at Ansty. For example, in 1946-47 the company only had a small stores there for covering the test-beds. Two years later they took over what is now known as No. 1 Shop to lay out a production assembly line for the Python turboprop engines scheduled for the Royal Navy's Wyverns. When this programme was tapered off, this shop, which has a floor area of 90,000 sq. ft, was used for the production of the initial batch of 28 Sapphire 6s. Some of these engines went to the United States, to form the basis of the American-built Curtiss-Wright J65, and others went to Switzerland; from this batch too came the engine for the prototype Vulcan.

When Python production was finally completed and the initial batch of Sapphires finished, No. 1 Shop was turned over to Python and Double Mamba repair work. It is now used for Sapphire overhauls; these are Javelin engines for the R.A.F. and this work is done under an Air Ministry contract.

In 1952-53, another large building—No. 2 Shop, with a floor area of about 70,000 sq. ft.—was taken over and laid out for the production of Double Mambas for the Gannet, Viper turbojets for the Australian Jindivik target aircraft, and the initial batch of Vipers for the Hunting Jet Provosts.

When it was eventually decided to transform Ansty into a self-contained engineering and development centre, Double Mamba production was transferred to the company's main factory at Parkside, Coventry, and all development engine assembly work was moved out to Ansty. Thus No. 2 Shop is now occupied with this work, and all production as such is done at Brockworth (Sapphires) and Parkside (Vipers and Double Mambas).

Round about this time an additional shop was built at Ansty as part of the "expansion programme" there. This is known as No. 4 Shop which covers some 100,000 sq. ft. and houses a large sheet metal development section and a comprehensive development machine shop, with a wide range of special machine tools.

Other important sections that are to be found at Ansty are accommodated in what used to be the aerodrome control and administration buildings—now known collectively as No. 3 Shop. These departments include a spares packing section, the photographic dark rooms and studios, and the model-making shop. Altogether the No. 3 Shop area is of the order of 52,000 sq. ft. In other buildings are located the headquarters of the company's aero-engine service department, the service training school, and the apprentice school.

As an integral part of the plan to make Ansty self-contained as an engineering centre, a new office block was planned. This new design office and production drawing office building, complete with administration offices and front hall, was finished and occupied by the middle of 1957. A second wing to house the technical and development engineers was completed shortly afterwards.

This spacious and handsome office block was designed and built to the Armstrong Siddeley specification by another member of the Hawker Siddeley Group, Kelvin Construction Co., Ltd., of Glasgow. And to help "keep it in the family" another Group company, Hawksley S.M.D., Ltd., of Slough, designed and built the curtain walling made from aluminium-alloy sheet and extrusions provided by yet another Group member, High Duty Alloys, Ltd.

A separate Rocket Division also has its headquarters at Ansty and is housed in a number of different buildings. It has its own design and engineering team and a separate test-bed site on the far side of the aerodrome. No details of Armstrong Siddeley's current activities in the rocket engine field are available but it has been said that the special test facilities at Ansty include a vertical firing test-bed equipped with closed-circuit television.

Altogether, the total payroll at Ansty numbers about 2,500 and even a brief visit shows that this is a well-knit and enthusiastic team. Under the leadership of Mr. W. H. Lindsey, M.A., F.R.Ae.S., M.I.Mech.E., the company's technical director, its excellent work is reflected in the successes enjoyed by Armstrong Siddeley's latest engines which are in service with the R.A.F. and the Royal Navy—and the high regard in which their products are held on both sides of the Atlantic.—F.T.M.

Here in conference at Ansty are, left to right, Mr. S. Allen, M.I.Mech.E., F.R.Ae.S., chief engineer (rockets); Mr. B. H. Slatter, B.Sc. (Eng.), A.F.R.Ae.S., chief technician; Mr. W. H. Lindsey, M.A., F.R.Ae.S., M.I.Mech.E., technical director; and Mr. A. Thomas, M.B.E., chief designer and deputy chief engineer.

THE FIGHTING SERVICES

Fleet Air Arm Progress

HAVING completed an intensive working-up programme with the Supermarine Scimitar, the experimental No. 700X Flight is being re-formed into No. 803 Squadron, the first operational unit to use this long-range transonic strike aircraft. After a brief spell of shore-based operations, No. 803 Squadron is due to embark with its Scimitars on the new fully angled-deck carrier H.M.S. "Victorious," for her autumn cruise.

Another important F.A.A. development is the formation of the first Sea Vixen unit, which will be No. 700Y Flight, for working-up trials with this all-weather fighter at Yeovilton.

R.A.A.F. in Malaya

FOLLOWING the current withdrawal of No. 1 Squadron R.A.A.F., with its Lincolns, from Singapore to Australia, nine Canberras of No. 2 Squadron, supported by two Dakotas, are due at Butterworth, in Malaya, on July 1 as the first flying component of the British Commonwealth Strategic Reserve in the Far East. The Canberras and Dakotas are due to leave Amberley, near Brisbane, on June 28, and will fly to Butterworth via Darwin and Tengah, Singapore.

Ground elements of the R.A.A.F., including a radar mobile control and reporting unit, have been at Butterworth for several months, and No. 2 Squadron will be joined there later this year by the Avon-Sabres of Nos. 3 and 77 Squadrons in No. 78 Fighter Wing. R.A.A.F. Butterworth will be under the overall command of the A.O.C. No. 224 Group, R.A.F., Air Vice-Marshal V. E. Hancock, C.B.E., D.F.C., of the R.A.A.F.

Transport support for the R.A.A.F. force in Malaya will be provided later this year by the Lockheed C-130 Hercules, 12 of which have been ordered to re-equip No. 36 Squadron in No. 86 Transport Wing. R.A.A.F. personnel are already training in the U.S. on these turboprop transports, the first of which is due to arrive in November this year. Delivery should be complete by January, 1959, and the C-130s will be primarily used for airlifting heavy vehicles and equipment.

MALAYAN CHANGES.—The Lincoln B.30s of No. 1 Squadron, R.A.A.F., (below) are returning to Australia in July from Singapore, after seven years of operations against the Malayan bandits. They will be replaced by No. 2 Squadron, R.A.A.F., with Canberras, which are also to re-equip No. 14 Squadron, R.N.Z.A.F., whose present Venom F.B.1s are seen in the background at Tengah (below) and in the air (above).

Photographs copyright "The Aeroplane"

R.A.N. Sea Furies Retired

AFTER an extensive modification programme, following their withdrawal from air squadrons in March, 1957, Sea Venoms of the Royal Australian Navy have returned to service, and the Hawker Sea Furies of the R.A.N. have therefore been retired. No. 805 Squadron, at Nowra, re-equipped from Sea Furies to Sea Venoms, in March, 1958, when No. 808 Squadron, also with Sea Venoms, embarked on H.M.A.S. "Melbourne" to Singapore.

The withdrawal of the Sea Venom F.A.W. Mk. 53s was necessitated by a weakness in the No. 2 wing rib following acceleration overloading during steam catapult launches, and the additional weight of ancillary equipment. While the aircraft were being modified, the decision was made to fit them all with Martin-Baker ejection seats, which, coupled with a general overhaul, required a lengthy withdrawal from commission.

P.F.O. Retirement

THE forthcoming retirement in September, has been announced of Gp. Capt. J. C. Kilkenny, O.B.E., Inspector of Physical Fitness, R.A.F., after 16 years' service in physical and parachute training work. The R.A.F. parachute jumping instructors are all drawn from the physical fitness branch, and Gp. Capt. Kilkenny's successor, Wg. Cdr. J. R. W. Blyth, who will become acting Group Captain, has been O.C. No. 1 Parachute Training School, R.A.F. Abingdon, since June, 1953, with more than 1,100 parachute jumps to his credit.

Gp. Capt. Kilkenny was Chief Instructor at the wartime R.A.F. Parachute School, at Ringway, and has made over 100 jumps.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captain J. A. Crockett to be Air Attaché, Rio de Janeiro. (He will also be accredited Naval and Military Attaché.)

Wing Commanders: G. N. Blake, M.B.E., to Air Ministry for duty in the Department of the Air Member for Supply and Organization (with acting rank of Gp. Capt.); G. F. Gordon, to No. 3 Radio School to command (with acting rank of Gp. Capt.); F. F. Addington, D.F.C., to R.A.F. Andover, to command; F. Bartle to Headquarters, Technical Training Command, for administrative staff duties; J. C. Button, D.S.O., D.F.C., to R.A.F. Middleton St. George for administrative duties; R. M. Coad, A.F.C., to Headquarters, Far East Force, for administrative staff duties; G. H. D. Evans, D.S.O., D.F.C., to Headquarters, Allied Air Forces, Northern Europe, for staff duties; G. W. O'N. Fisher, O.B.E., D.F.C., to R.A.F. Binbrook, to command No. 139 Squadron; R. E. W. Harland to Ministry of Supply for duties with British Joint Services Mission, Washington; M. M. Kane, M.B.E., to R.A.F. West Drayton, to command, and as R.A.F. Liaison Officer; J. L. Kerr to Headquarters, Transport Command, for transport support duties; H. A. Lax to Allied Air Forces, Northern Europe, for staff duties; J. B. Lewis to R.A.F. Changi (Singapore), for administrative duties; J. Shearsmith, A.F.C., A.F.M., to R.A.F. Bawdsey.

Squadron Leader E. J. Wilson to the R.A.F. Records Office, Gloucester, for administrative duties (with acting rank of Wg. Cdr.).

The Anglo-French Alizé "Sub-killer"

ALTHOUGH the Fairey Gannet is being replaced for anti-submarine duties in the Royal Navy by sonar-equipped helicopters, the French consider that a requirement still exists for a long-range radar-carrying "hunter-killer" aircraft in this role. Given superlative electronic equipment, a fixed-wing aircraft is thought to offer several advantages in mobility for submarine detection and destruction, although restricted to operation from conventional carriers, and the Breguet Alizé is being produced in support of these principles for the French Navy.

The Société Louis Breguet is well known as one of the most versatile of the French aircraft manufacturers, and its current production and development range extends from sailplanes, through the massive Deux Ponts transport, the Br.940 STOL aircraft, and the Taon lightweight strike fighter to the Alizé itself. Seventy-five of the latter have been ordered by l'Aéronavale, and are being produced at the Breguet factory in Toulouse (Montaudran), final assembly taking place at Biarritz (Bayonne), alongside completion of the Breguet 765 Sahara. Other Breguet establishments include a factory at Villacoublay (Velizy), just outside Paris, specializing in prototype work, and the Aire-sur-Adour plant, devoted to glider production, and eventually also to light aircraft.

Throughout its prolonged development, the Alizé has provided an excellent example of Anglo-French technical co-operation, which happily is steadily increasing, with mutual benefit. Not only have the development series been exclusively powered by British engines, but much of the performance testing for carrier-borne operations of the Alizé has been done from British ships or shore establishments.

The Alizé had its origins in a two-seater strike aircraft, the Breguet 960 Vultur, which was designed in 1948 for the French Navy. The Br.960 employed a mixed-powerplant concept with a nose-mounted Armstrong Siddeley Mamba A.S.Ma.1 of 980 s.h.p., and a 4,850 lb. Hispano-Suiza Nene 101 in the rear for take-off and combat power.

The first prototype Vultur flew on August 3, 1951, while the second, with a 1,320 s.h.p. Mamba A.S.Ma.3 and a 5,005-lb. Nene 104, made its initial flight on September 15, 1952. The Breguet 960-02 later completed a series of dummy deck landings and catapult-assisted take-offs at Farnborough, and proved fully capable of completing its designed role.

As is so often the case, this role was then abandoned, because of the rapid increase in performance of opposing fighters, and in 1954, the French Naval Aviation staff issued new requirements for a standard single-engine anti-submarine aircraft, for operation from the new 23,000-ton French carriers "Clemenceau" and "Foch." A new design, the Breguet 1050, was then initiated, and in the meantime, the second prototype Vultur was modified to incorporate many of its characteristics, as a technical and operational "flying test-bed." The rear-mounted Nene turbojet was removed, and some of the space occupied by a radome, while a large fuel tank in the forward fuselage was delcted to allow a third occupant and extensive radar equipment to be carried in the cockpit. The canopy was also modified, and to round off the general similarity to the Br.1050, false undercarriage stowage nacelles were built on to the wing leading-edges.

Although under-powered with only the Mamba, the Breguet 965, as the modified Vultur prototype was designated, facilitated checking of the general aerodynamic characteristics of the Alizé from its first flight on March 26, 1955. After completing all its planned programme, the Br.965 eventually made an emergency landing with only one leg of the undercarriage extended, and terminated its career at Istres.

The first prototype Vultur retained the mixed-powerplant layout, but was modified for special boundary layer control tests, as the Br.963. Air was tapped from the compressor of the Nene for flap blowing, and the experiments provided a great deal of useful data in flight trials from March, 1955, onwards.

The specification for the Breguet 1050, later known as the Alizé, was similar in many respects to that of the Gannet, but a single Rolls-Royce Dart turboprop unit was selected as a power unit, on the basis of its reliability, long life and low specific fuel consumption at the patrol altitudes of 2-3,000 ft. By retracting the undercarriage into separate nacelles, most of the wing became available for fuel stowage, giving a normal patrol endurance of about 4½ hr. on internal tanks.

Wooden mock-ups of the new design were made, in Toulouse, to position the vast amount of electronic and other equipment. The main search radar was a new and very powerful installation by the C.S.F. company, with an output of no less than 250 kW., and mounted in a retractable radome beneath the fuselage to give 360-degree coverage. Provision was also made to instal MAD (Magnetic Airborne Detection) search equipment in a retractable boom extending from the rear fuselage—to meet NATO requirements—although this is not specified by the French Navy.

Aerodynamic test models of the Breguet 1050 were also made, for detailed study of certain design characteristics in the Breguet subsonic wind-tunnel, following the general flight evaluation with the Breguet 965. In tests of the effect of power increase on stability, the models showed that increased area was necessary on the vertical and horizontal tail surfaces, and that the tailplane should be lowered, while, to improve the maximum usable lift when landing, slots were incorporated in the flaps. Other model tests involved the evaluation of control surface hinge moments, reducing drag by cleaning up the wing and nacelle junctions, and stability and ground effect checks.

One of the final features of the model tests was a quantitative spin analysis in the Lille vertical tunnel. The 1/20th-scale model was equipped with small actuators to permit control surface displacement, flap and undercarriage-door extension, and spin-parachute deployment. The spin was found to be more stable in inverted than in normal flight, and to result in a descent attitude of about 45 degrees, with the wings level. Rotation was at a rate of 3.5 seconds per turn, with a rate of descent of about 14,000 ft./min. Recovery was conventional.

Ditching tests, with tethered models, were conducted in the circular hydrodynamic test tank at St. Cyr, and their success was confirmed by a free-flight programme at Lille. At an equivalent weight of 14,100 lb. (no military load and one-

The Alizé was evolved from the earlier Breguet 960 Vultur, which was a carrier-borne strike aircaft, powered by an Armstrong Siddeley Mamba turboprop and a Rolls-Royce Nene turbojet.

Bristling with electronics, the Alizé combines "hunter-killer" capabilities in the anti-submarine rôle. The perforated air brakes on the rear fuselage of the second prototype (nearest camera) are not fitted to production aircraft.

quarter fuel), and a C.G. location of 22%, with normal flare-out landing technique, the models showed no tendency to "tuck under" when ditching, even at steep slide angles, and maintained a straight path through the water after impact at pronounced angles of yaw. They remained controllable at all times, although on some occasions the undercarriage nacelles broke away and the radome was sucked out.

Powerplant Installation

After the selection of the Rolls-Royce Dart as the powerplant for the Alizé, its installation was a matter of close liaison between the British and French companies, and a Rolls-Royce engineer, Mr. B. W. Murphy, has been based at Toulouse specifically to assist the project since before the first prototype flew. Prototypes 01, 02 and 03 had the Dart R.Da.20, the first two having ventral jet pipes, and the third, a short over-wing tailpipe.

The fourth and fifth prototypes, which had the "production type" Dart R.Da.21, started life with underwing jet pipes, but 04 has since been modified to have the definitive long over-wing type giving extra thrust. This arrangement also avoids the harmful effects of efflux heat against the folded wings from the short side tailpipe, or deck- and wheel-heating from the former ventral position.

The Dart R.Da.21 is an intermediate engine between the R.Da.6 (Dart 511) and the R.Da.7 (Dart 520), used respectively in earlier and current production types of Viscount, and incorporates a three-stage turbine matched with a Dart 510 compressor. Take-off power of 1,950 s.h.p. at 15,000 r.p.m. is the same as for the R.Da.7, although the fuel consumption is lower, and is maintained at high ambient temperatures by water-methanol injection. The maximum s.h.p. is augmented by 410-lb. residual jet thrust.

All the engine and fuel controls were modified to withstand the very high g loadings involved in carrier operation, and have since been extensively tested under simulated and actual deck conditions. The accessory gearbox was modified to drive simultaneously the generator and alternator, which was necessary because of the very heavy load imposed when all the electronic equipment is in operation.

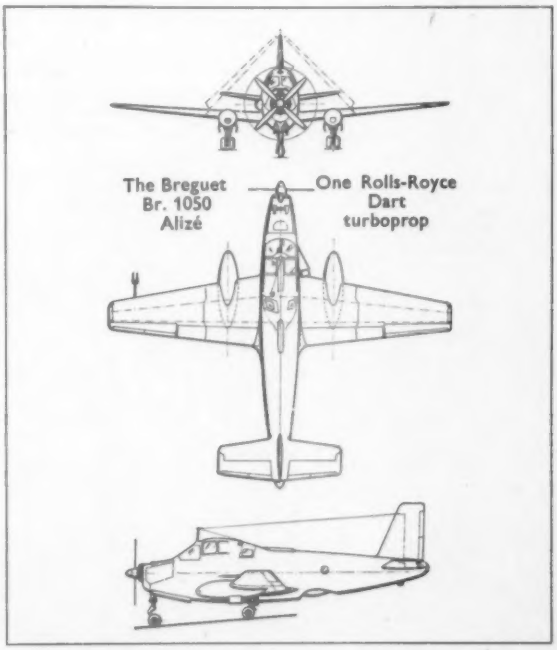
The low vibration level of the Dart has proved of great assistance in maintaining the serviceability of the electronics, and the reliability of the engine from its airline service (where its major overhaul period is now 1,500 hours or more) was recently confirmed by the successful conclusion of a 150-hr. type test to civil requirements of the R.Da.21.

As in the Viscount, the Dart in the Alizé drives a Rotol-designed airscrew, which is manufactured under licence by Breguet as the Br. 4-1000. It is a four-bladed duralumin type of 11-ft. diameter, with electric leading-edge de-icing, and retains its feathering capabilities in the Alizé to reduce windmilling drag in the event of power failure.

Flight Test Programme

Five prototypes of the Alizé had been ordered for flight testing, which began on October 6, 1956, when the first one made its initial flight at Toulouse-Blagnac, but wind-tunnel testing continued on a correlated basis. In the performance field the realized C_L max., flaps down, was higher than indicated by model tests, because of a Reynolds effect, while the actual airscrew thrust was higher than expected, through reduced interference on the full-scale aircraft. Stall evaluation was found correct, as were the hinge moment measurements for the elevator. Full flight trimming had to be developed for the ailerons, and the rudder was found difficult to trim, necessitating the introduction of a directional servo-control.

The first prototype completed 45 flight test hours in the same number of days after its initial flight, despite the loss of two weeks for minor flight control modifications. Powered by an R.Da.20, the Br.1050-01 was used for investigating flight



For carrier qualification trials, the third and fourth prototypes of the Alizé completed nearly 100 successful take-offs and landings from the deck of H.M.S. "Eagle" earlier this year. This view of the Br. 1050-04 shows the double-slotted flaps and arrester hook extended for landing, and also the fuselage apertures for launching sonobuoys.

characteristics and performance, and after completion of that programme it went to the naval flight test centre at Istres, near Marseilles. A series of dummy deck landings was followed in March, 1957, by catapulting and arresting trials in England, at Bedford; and finally the 01 was vibration-tested as part of a flutter investigation flight programme.

The third prototype, originally with the R.Da.20 and overwing jet pipe, and later with the "production" R.Da.21, was also sent to the Royal Aircraft Establishment at Bedford in January, 1958, for dummy deck operations, which were successfully concluded. In catapulting tests the Alizé proved very satisfactory at accelerations of up to 5.1*g*, with good stability on release and no adverse effects on the fuel supply.

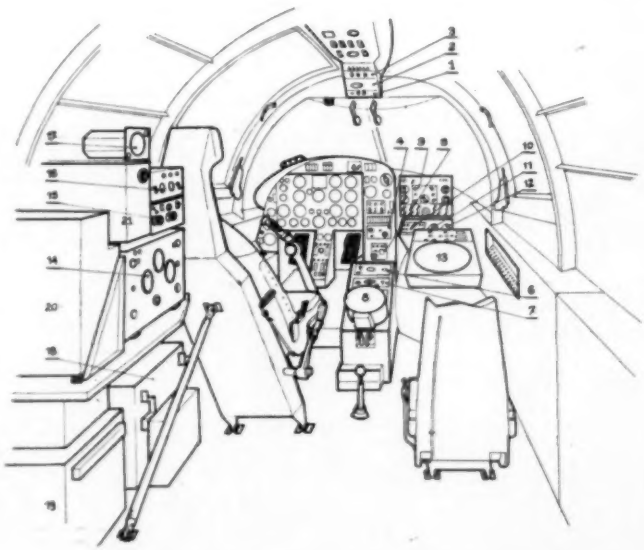
In arrester-gear tests, decelerations were experienced up to 3.7*g*, with no vibration or structural defect even in "out of line" conditions, and no unusual wear of cable, hook or tyres. Recommended speeds for carrier operation were established as 100 knots for catapulting at the maximum weight of 18,100 lb., and 85 knots for deck-landing approach at 15,700 lb. In common with all French naval aircraft, the Alizé incorporates an angle-of-attack three-light indicator to give visual signals showing the optimum approach speed for deck-landing.

Tests were also conducted for armament evaluation and weapons accuracy, while operational trials were recently performed for search and strike procedures.

The second prototype Alizé was used to develop the electronic equipment, and the radio and radar aerials were repositioned until interference was eliminated and the radiation patterns were satisfactory. It was then delivered to l'Aéronavale at St. Raphaël for intensive flying and operational evaluation, averaging 6 hr. in the air per day. The Br. 1050-05 was used for final evaluation of the electronics, including the new C.S.F. radar, before joining 01 and 03 at Istres. The fourth prototype, with an R.Da.21 powerplant, was fitted with the rudder servo system, and brought up to production standards. It completed an extensive performance evaluation, followed by structural flight limit investigation and airscrew vibration tests.

The most recent test phase of the Alizé involved extensive deck-landing trials, which took place in the Mediterranean on H.M.S. "Eagle," as no suitable French carriers were yet available. On March 9 and 10 the third and fourth prototype

(*Continued on page* 901)



Equipment layout of the Alize

KEY

1. IFF control panel.
2. IFF combination box.
3. Radio-compass control panel.
4. HF control panel.
5. UHF control panel.
6. Interphone control panel.
7. VHF control panel.
8. Radar scope.
9. Sonobuoy receiver.
10. Sonobuoy jettison control.
11. D.R. computer grid indicator.
12. D.R. computer azimuth indicator.
13. Position indicator.
14. Dead-reckoning computer.
15. Navigator interphone.
16. Intervalometer.
17. Main heading indicator.
18. HF transmitter.
19. IFF transmitter.
20. HF antenna tuning box.
21. Wire recorder.

The Breguet Br. 1050 Alize

1. UHF aerial.
2. HF aerial.
3. Radio-altimeter aerials.
4. VHF aerial.
5. Radio-compass loop and sense aerials.
6. Sonobuoy receiver whip aerial (port nacelle).
7. Homing aerial.
8. Catapult hook.
9. Omni - directional sonobuoys.
10. Weapons bay.
11. Inverters for radar.
12. Hydraulically retractable 250-kW CSF radar.
13. Arrester hook.
14. Generator and alternator.
15. Fuselage and wing fuel tanks.
16. Hold-back fitting.
17. Rockets.
18. Wing-fold jacks.
19. TACAN aerial (below fuselage).
20. Provision for Magnetic Airborne Detection Gear.
21. Hispano-Suiza undercarriage.
22. Rolls-Royce Dart R.Da.21.

(*Continued from page* 900)

Br. 1050s successfully completed nearly 100 free and accelerated take-offs and arrested landings from "Eagle," at various operating weights, in very rough weather conditions, with winds of up to about 50 knots. The Alizé proved an admirable deck-landing aircraft, with good stability and control, and excellent low-speed characteristics.

In its undercarriage design, the Alizé conforms to the R.N. specification for vertical velocity absorptions of 5 m./sec. (16.4 ft./sec.), at a design weight of 18,100 lb. The landing gear is of Hispano-Suiza design and manufacture, with twin main-wheels and a single nosewheel, having identical tyre sizes. The short main legs retract forward into the wing nacelles, while the longer nosewheel strut folds aft into the fuselage.

An interesting system of nosewheel steering is employed for precise control, comprising a limited range of movement through the medium of the rudder pedals for use during take-off and landing, and a wider steering range for taxi-ing via a retractable tiller on the instrument panel. This arrangement greatly facilitates deck manœuvrability.

Hydraulic power, through a 3,000-p.s.i. Hispano-Suiza system and a manual emergency pump, operates the undercarriage, brakes, wheel and weapons bay doors, flaps, radome and arrester hook, as well as the wing-fold jacks.

Conventional Construction

As befits its rôle of a flying radar platform, with an additional offensive capability, the Alizé is a straightforward all-metal cantilever design, with an emphasis on ruggedness for carrier operation, coupled with light structure and easy maintenance. The wing is a simple straight tapered design, with a t/c ratio varying from 15% at the root to 10% at the tip, and is built in four sections. The straight-folding outer panels carry the ailerons and outboard flaps, while the inner wing sections include the inboard flaps, fuel tanks and the nacelles housing the main undercarriage and part of the armament.

In its production form the Alizé is being built in sections, the main fuselage components being the nose, centre and rear units. Beneath the cockpit, in the centre-fuselage, is a capacious weapons bay, while the rear section houses the retractable radome, and the arrester hook. The rear fuselage is built mainly of non-magnetic materials to facilitate the installation of MAD, should this be required. Fuselage construction is otherwise completely conventional.

The tail surfaces comprise a fin torsion box, with a three-point attachment to the fuselage, and a horn-balanced rudder, plus two tailplane torsion boxes, with similar pick-ups, and having wide-chord elevators. Full-span trim tabs are fitted to all control surfaces.

The flying controls are operated by rigid light-alloy or steel push-pull tubes, with fork fittings. Aileron disconnection at the wing folds is by means of contact rollers. As already mentioned, the rudder is hydraulically boosted to assist trimming.

To conform with the French specifications for carrier-borne aircraft, the Alizé, at 18,100 lb., has a maximum limit load factor of 4.4*g*, and an ultimate load factor of 6.6*g*. The maximum design dive speed, clean, is 320 knots, IAS, and with radome extended is 250 knots, IAS.

Wing and fuselage fuel tanks give a normal total capacity of 462 Imp. gal., but for ferrying or extra long-range operations a 105-gal. auxiliary tank may be fitted in the bomb bay. The maximum permissible tankage is likely to be 633 Imp. gal., with an additional weapons bay tank.

The Alizé can operate on JP-1 (kerosene) or JP-4 and 5 wide-cut fuels, the last-mentioned normally being used. Water-methanol injection is available to maintain engine power in high ambient temperatures. Refuelling is by pressure or gravity method. Fuel jettison is possible for emergency landings.

Extensive use is made in Alizé production of a form of envelope jigging, with large plaster and glass-fibre moulds for the skin panels, to which the internal structure is then attached. This technique, which was pioneered in this country by the Fairey Aviation Co., results in a high-quality surface finish and good interchangeability of the many sub-assemblies.

With a crew of three, comprising pilot and two radar operators, who are accommodated in a very roomy cockpit in which it is possible to change places and move about, the Alizé is capable of several missions from ship or shore bases. On anti-submarine duties, it can carry on a radar search for more than 4 hr. at low altitude, using in addition electronic counter-measures, markers and omni-directional sonobuoys, while armed with rockets, depth charges and torpedo. On normal internal fuel, its maximum endurance, at 125 knots, with radome extended, is over 5 hr.

For shipping strikes, with the same detection equipment, the Alizé can be armed with rockets, torpedo, bombs or guided missiles, which may also be used for coastal patrol. It has underwing racks for rockets, depth charges, flare launchers or air-to-surface missiles, while the weapons bay can accommodate a torpedo or three depth charges. An interesting feature is the use of the forward part of the undercarriage nacelles as bays to carry a number of omni-directional sonobuoys, which may also be launched from tubes in the cabin.

For long endurance patrols an auto-pilot is essential and a SFENA 318 electrical three-axes unit is provided, with altitude and heading stabilization. It may also be linked with the radar.

Although undramatic in design, the Alizé fulfils an exacting specification through its capacity to accommodate a large amount of advanced detection equipment alongside a useful armament, and to transport both over very large sea areas. A single-engine design for this sort of duty might prove a disadvantage if any other powerplant but the Dart were fitted. As it is, the low powerplant weight contributes a great deal to the excellent military load potential of the Alizé, whose good operating economics should be a useful asset in the export market.—J.E.F.

Technical Data

Dimensions.—Span, 51 ft. 2 in.; folded, 23 ft.; length, 45 ft. 6 in.; height, 17 ft.; wing area, 387.5 sq. ft.

Weights.—Max. deck-landing weight, 15,700 lb.; max. catapulting weight, 18,100 lb.

Performance.—Max. speed (sea-level) at 17,600 lb., 248 knots, (10,000 ft.), 254 knots; normal patrol speed, 120-180 knots; max. continuous speed (sea-level), 232 knots; initial climb, at 18,100 lb., 1,380 ft./min.; wave-off climb, at 15,700 lb., 1,180 ft./min.; service ceiling, at 17,650 lb., about 20,000 ft.; max. ferry range, 1,350-1,550 n.m. at 11,500 ft.; max. endurance, with additional fuel, 7½ hr.; take-off run (on runway, at sea-level), 1,890 ft.; landing run, 1,540 ft.

Neil Macdougall

REPORT FROM HOUSTON

Howard Levy photographs

PERHAPS no armed forces in the Western World are more aware of the value of good public relations than are the American Services. Each year they make a special effort for the Aviation Writers' Convention, supplying not only elaborate displays planned by senior officers, but also rides in Super Sabres and Cougars, and transportation from all parts of the country.

Last month Service aircraft flew some 150 writers and manufacturers' public relations men to the convention site at Houston (Texas) from Wichita, New York, San Francisco, Washington, Los Angeles and Chicago. The New York group for example, arrived in two Convair C-131Es (the Air Force version of the 440 Metropolitan), supplied by the Vice-Chief of Staff's office, and complete with white-coated steward. (General LeMay's office also has several B-57 Canberras, two of them painted all white, for executive transport. He often flies them himself.)

The way in which the Services cultivate the Press can be seen from a decision to refuel at Nashville's civil airport because lounge facilities for the passengers were better than at the military field. Unfortunately, the Air National Guard unit, whose modern F-84F Thunderflashes contrast with the aircraft flown by the Commonwealth's auxiliary squadrons, did not have any 115-145 grade fuel. The local air line refused to sell us any; we trust they would be more co-operative in wartime. This necessitated a 10-minute flight to Sewart Air Force Base, the headquarters of the Air Division which air-lifted troops to Puerto Rico after the recent incidents in Venezuela.

Neatly lined up, row upon row, as though for a Royal inspection, were about 100 C-130 Hercules and C-123 Provider troop transports. Such a fleet on a vast hardstand is a sobering sight for a taxpayer, but an uplifting one for a Lockheed or Fairchild shareholder. Although Sewart is only one of several U.S.A.F. troop carrier bases, its aircraft have a capacity exceeding that of many of the air forces of the World. Station members said the fleet was flown once a week to dust them off.

The Aviation Writers' conventions provide an important show place for the manufacturers and services. The second prototype Lockheed Jetstar was flown this year, although plans to show the Lockheed Electra and the Boeing 707 dissolved under pressure from the C.A.A. certification trials.

On May 26 the U.S. Navy flew the Press in R5Ds (DC-4s) 200 miles to the Naval Air Station at Corpus Christi, Texas. This base is headquarters of the Advanced Training Command and the "Corpus complex." For once military jargon is descriptive, for few things are more complex than the ring of satellite and auxiliary fields, separate prop and jet traffic patterns, and functional flying areas. Corpus Christi is responsible for all Navy flying training in piston-engined aircraft, and accordingly operates large numbers (variously estimated at four or five hundred) of AD Skyraiders, S2F Trackers, P2V Neptunes and SNB Expeditors.

Flying-boat training is carried out in P5M Marlins and tattered PBM Mariners. F8F Panthers, F9F-8T Cougar trainers, Constellations, R5Ds, Lockheed TV-2 jet trainers and assorted helicopters are also used.

Corpus Christi alone is said to launch 200 aircraft per day. High equipment utilization and outdoor maintenance are facilitated by the excellent weather. At the end of the day, the sight of formations of Skyraiders roaring in from the bombing ranges is a nostalgic one, recalling the War. Because of air traffic control problems, much of the jet training has been shifted to the nearby Naval Auxiliary Air Stations which are located at Chase Field and Kingsville.

PODDED BOMBERS.—Above, in the foreground, a Convair B-58 Hustler with both engines and disposable load podded; behind it, a Boeing B-52 Stratofortress with engines and extra fuel podded. In the top picture, the B-58 is visible again with B-47, KB-97, B-52E, KC-135, Snark, Thor and Jupiter missiles. Both pictures were taken at Houston.

In a belated "most significant step in the history of basic flight training," the U.S. Navy will begin next August to evaluate all-jet training. One group of *ab initio* students will train on the new Temco TT-1 Pinto rather than on the present Beechcraft T-34 Mentor. After 40 hours' instruction, they will do 120 hours on the Lockheed T2V-1 SeaStar. Another group of students will do their primary training on Mentors. Advanced training for both groups will include 140 hours on the swept-wing F9F-8 Cougar and F9F-8T Cougar trainer.

The Navy hopes to reduce the number of jet accidents by this conversion, although the cost of training is expected to be more than the present $100,000. Earlier weeding out of misfits is another expected advantage.

A feature of the writers' visit was a fire-power display by Air Development Squadron Five (VX-5) from China Lake, Calif. This unit is responsible for developing and evaluating delivery techniques and tactics for nuclear weapons, including en route, delivery, escape, navigation and cruise-control procedures for each type of aircraft in fleet use. To ensure that the manœuvres developed are within the capability of average Fleet pilots, the unit is staffed by pilots seconded from the Fleet.

The growing power of nuclear weapons has made difficult the problem of escape by the attacking aircraft. Several techniques were demonstrated using bombs similar in every way except blast to nuclear weapons. The models proved to be somewhat larger than a Sabre drop-tank, with a pointed nose and four fins.

High-altitude glide bombing was shown first by an FJ-4B Fury, and then by an A4D Skyhawk. The former rolled into a 70° dive from 25,000 ft., then rolled out in time to release its weapon at 16,000 ft. The two targets were two old Mariner flying-boats, anchored off the breakwater. Both drops were within 100 ft. of the target.

Although dive bombing is accurate it does subject the attacker to ground fire for a considerable time, so that medium-angle loft bombing is preferred for well-defended targets. Another

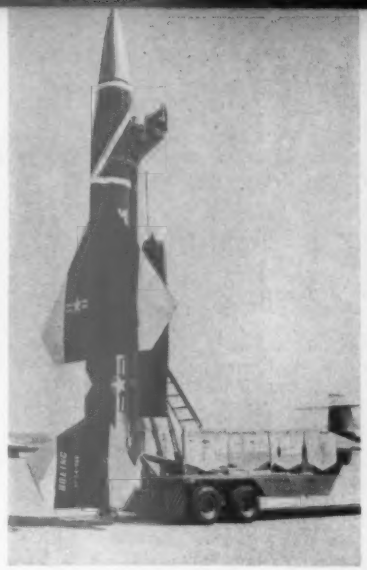
Fury approached over the water at 50 ft., pulled into a 45° climb and released its bomb while five miles from the target. VX-5 is currently developing this technique for the DC-3-size Skywarrior (A3D), which rolled over with alacrity after bombing.

A variation of this technique is over-the-shoulder loft bombing, in which the weapon is released while the aircraft is climbing inverted in the first part of a loop. A smoke trail made it easy to follow the red bomb, which rocketed, as though powered, 5,000 ft. upward from its release point. Although this method was said to be the least accurate of those demonstrated, it produced the nearest miss.

A method which is supposed to afford even greater separation between the blast and the attacking aircraft is 90° loft bombing, which was shown for the first time. This method requires a low approach and a pull-up into a vertical climb over the target, when the weapon is released. The bomb in the demonstration rose for several thousand feet above the release point, poised momentarily, and fell through its own smoke to within 50 ft. of the target.

Unfortunately, the Skyhawk's engine flamed out while the aircraft was inverted. The white puff of smoke from the aircraft seemed part of the display until a background voice on the public-address system said, "We've got a Mayday." The commentator continued his presentation while an HO4S helicopter scuttled over to pick up Lt. Cmdr. Caubble, who had ejected at 3,000 ft. "The Angel," as Navy pilots call it, was hovering near the point of impact before the distant parachute hit the water. The helicopter then landed in front of the Press stands, delivering the still dripping and nervous pilot to a microphone.

That event having ended happily, the display continued with the firing of a Martin Bullpup air-to-ground missile from a Fury. This missile system was conceived as an answer to the high loss rate among ground-attack pilots in Korea. It is designed to be launched from outside the effective range of ground fire and still be sufficiently accurate to destroy small targets like tanks, vehicle convoys, bridges and ships. Development started in 1954, and the missile is now operational. (It is worth noting that the U.S.N. has operational missiles in each of the four main classes of missiles.)



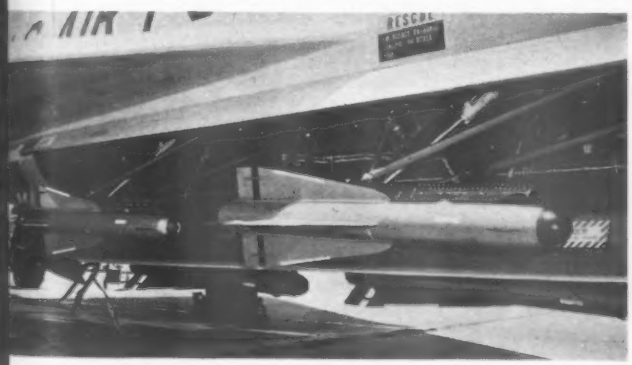
ON THE MARK.—Pointed skyward from its mobile launcher is a Boeing Bomarc ramjet-powered interceptor missile.

The Bullpup is a beam rider, guided by the launching pilot. A pilot using one for the first time is supposed to have scored a direct hit on a target 4 in. square. In any case, the Bullpup blew off the wing-tip and float of one Mariner, which subsequently sank.

In the next demonstration, a Crusader was to fire a target rocket, on which a Sidewinder missile would home. As so often happens in displays (and in wartime), the weapon failed to release.

Also under development by VX-5 is the "buddy" in-flight refuelling system. The optimistic commentator said that nuclear weapons are so powerful that only one aircraft will need to be launched against each target. It is now planned to launch two aircraft of the same type, one of which will act as a tanker and go only part way to the target. This method eliminates the uncertainty and difficulty of rendezvousing with a different type of tanker aircraft under conditions of radio silence, weather and darkness. Both the Fury and the Skyhawk can carry "buddy" tanks, which are over-size drop tanks with a built-in, retractable refuelling drogue.

On the ground, the Fury's probe carried a sign, "Danger, radiation, keep away." We assume that a radio-active substance on the probe is used to illuminate the drogue, in the



MISSILE MIX.—In one weapons bay of this F-102A is a Hughes GAR-1 Falcon radar guided missile, right, and a GAR-2 Falcon infra-red guided missile, left.

RECONNAISSANCE RADOME.—An R.C.A.F. Canadair Argus reconnaissance aeroplane of the Maritime Air Command was on show at Houston. Its large nose radome is distinctive.

FURY FUELLER.—Tanker aircraft for "buddy" refuelling is this North American FJ-4B Fury.

EXECUTIVE JET.—The second Lockheed Jetstar lands at Houston. This Bristol Orpheus-powered executive jet costs about $1 million.

fashion of a luminous numeral on a watch, or perhaps as a lightweight device to tell the tanker pilot the location of the receiver, Geiger-counter style.

The flying display concluded with formation aerobatics by the ever-competent Blue Angels, flying F11F Tigers. Red and blue smoke trails added to their spectacle, and two solo performers maintained interest while the four-plane formation was changing direction. A new manœuvre added this year is the sandwich, in which two Tigers sweep past in close formation at 100 ft. with the upper aircraft inverted.

Over luncheon, Rear Admiral J. T. Hayward, assistant chief of naval operations (research and development), said that the missile-submarine combination was the greatest threat to the free World. The U.S.'s strategic bombardment missile programme had been poorly planned, and foreign bases could not be relied upon. Larger carriers were the answer, he thought, because of their mobility. The "Forrestal" class carriers could stay at sea for 350 days a year, compared to a maximum of 200 for the smaller and older "Essex" class.

Afterwards, to observe the effect of sonic booms, we were driven over bumpy roads, with plenty of sub-sonic booms, to a deserted airfield in the midst of the King Ranch. This farm is in keeping with Texans' passion for size, for it is about 16 by 45 miles, and contains almost 1,000,000 acres.

The Navy had built two substantial, multi-windowed shacks in the middle of the airstrip, which were to be the targets. Sonic dives were made on them from 40,000, 30,000, 20,000 and 10,000 ft. by four Tigers. A barograph was used to record changes in pressure, while photographers set up remotely controlled cameras inside the hut in the hope of photographing the panes shattering, with the aircraft in the background. The four dives produced double booms ranging from a dull thud to a sharp crack, but none did any damage.

Atomic explosions have provided considerable information on the forces needed to do structural damage. Shock waves generated by an atomic blast have not caused damage to the flimsiest structures when the pressure was less than 70 lb./sq. ft. It takes at least 18 lb./sq. ft. to shatter pane glass. Tests on homes and industrial buildings of brick, block and frame construction have shown that it takes 150 to 300 lb./sq. ft. to cause damage ranging from plaster cracks to roof cracks.

A sonic boom created by an aircraft diving from 35,000 to 25,000 ft. produces a pressure of about 5 lb./sq. ft. on the ground. Nevertheless, when a sonic boom occurs, the authorities are invariably flooded by complaints from individuals "who have made a thorough inspection of their homes, probably for the first time, and who file claims for reimbursement of damages which may have long existed." In the United States, a 30,000-ft. minimum has been imposed for supersonic flights over land.

A Navy Tiger and an Air Force Super Sabre flew at supersonic speed directly over the buildings at 1,000 ft. The resulting double cracks startled the crowd, but recorded only 6 lb./sq. ft. on the barograph, and did no damage at all.

Somewhat less spectacular, but with greater import, was a demonstration of the new Sikorsky HSS-1N helicopter. With a new automatic "hover coupler" which uses radar to determine ground motion, it is possible for the pilot to place the helicopter on automatic control at 200 ft. altitude and 80 knots airspeed and automatically to come to zero ground speed at a 50-ft. altitude over a pre-selected spot. Test pilot Jack Stultz did just that, while waving his arms and even one foot out the window. This equipment should be particularly useful when hovering with "dunking-Sonar" on anti-submarine patrols, for helicopters are notoriously tiring to fly.

The Navy also announced that five World time-to-height records had been broken by Major Edward N. LeFaivre, U.S.M.C., in a production-model Douglas F4D-1 Skyray (one 10,200-lb. st. thrust P. & W. J-57-P8). The records were made at Point Mugu, California, on May 22-23, and broke four records previously held by a Nord 1405 Gerfaut 88. The new records from a standing start are: to 3,000 metres (9,842.5 ft.), 44.39 sec.; 6,000 metres (19,685 ft.), 1 min. 6.13 sec,; 9,000 metres (29,527.5 ft.), 1 min. 29.81 sec. and 12,000 metres (39,370 ft.), 1 min. 51.23 sec. It was also revealed that one Skyray unit is operated by the U.S.A.F. Air Defence Command.

An international flavour was added to the show by the R.C.A.F.'s Canadair Argus. Seen for the first time was one CF-100 rocket pod on a pylon under each centre section. The roominess of the crew quarters (complete with pop-up toaster) impressed the Americans.

Southend's New Lighting

FOLLOWING the installation, last year, of normal low-intensity and line-and-bar approach lighting for the main 24/06 runway at Southend Airport, a new G.E.C. high-intensity runway lighting system, the first of its kind at a British civil airport, has recently been laid down.

This lighting, as experience during a local night flight demonstrated for us, showed something of the work that is now being done to remove the "black hole" effect for the pilot after he has passed the approach lighting. Furthermore, it provides a clear and complete perspective pattern of the runway and its approaches. This, in conditions of low cloud or poor visibility, not only gives a useful visual positioning aid, but also helps greatly in the judgment of final approach. High-intensity runway lighting of this kind is a more than useful extension of the approach lighting pattern and the perspective of the runway can be judged during an approach at night—just as this is normally judged during the day. The pilot is no longer flying into the darkness beyond the approach pattern.

There are five steps of brightness for the lighting, which is controlled, by an electronic system, from the control tower. Normally, at night, only the lower intensities would need to be used—with the runway and approach lighting at a similar level of brightness—but in bad weather the higher intensities can be used for guidance while an aircraft is in circuit and then reduced, at the wish of the pilot, during the final stages of the approach. The lights for the last third of the runway, seen from either end, are amber coloured.

Later this year two angle-of-approach indicators are also to be installed. These will be high-intensity versions of the conventional three-colour units.

The new lighting units employ a heat-resisting single-piece glass reflector giving a bi-directional light distribution of 35,000 candelas maximum, with an omni-directional component of 3,000 candelas. The system includes high-intensity unidirectional green threshold wing bars. The original runway lights are to remain as stand-bys, but the units will be moved back from the runway edge.

The air-to-ground visual demonstrations for the visitors last week were provided by Southend Flying School pilots and Austers. Visibility was excellent, but the cloud-base was 800 ft., with fragments at 600 ft.—so the value of the lighting could be quite adequately judged.

The new high-intensity runway lighting for the main runway at Southend Airport as seen when approaching from the north-east. Note the wingbar lights at the threshold.

CORRESPONDENCE

That Expensive Instructor's Rating

IF I can find sufficient money I can learn to fly and qualify for a Private Pilot's Licence, the issue of which costs me 5s. If I find more money I can qualify for a Commercial Pilot's Licence, the issue of which costs me another 5s. But if I am sufficiently interested in flying to train for one other licence I am charged the appalling sum of £4 4s. for its issue, £3 3s. for a retest if I should fail first time, and £1 10s. for renewal each year (reduced to 15s. when I graduate to a higher grade). For such a sum one would expect to receive at the very least an extra special licence, but no, it does not entitle me to a licence at all, merely a recommendation to the M.T.C.A. to issue me with a licence, which the Ministry then do for no charge.

I am referring, of course, to the Instructor's Rating. I make my own arrangements for the test, pay *every penny* of the cost of it and the examiner receives no fee. Where, then, does my money go? Presumably there is some small cost in keeping records, typing letters, etc., but the M.T.C.A. are able to cover this by 5s. a head, and from them I am also entitled to the privileges of receiving a vast amount of up-to-date information about aviation, and I may even be prosecuted by their solicitors.

I can also get from the Ministry exact information as to the course of training necessary for a P.P.L. or C.P.L., whereas with the Guild of Air Pilots and Air Navigators I must contact the particular individual who will test me to find out his own rulings about the amount of Night Flying, Instrument Flying, Aerobatics and Hours on Type necessary, for each examiner makes his own arbitrary rules according to his fancy and these usually differ radically from those of any other examiner. G.A.P.A.N. has not even laid down a systematic Instructors' Course.

When I have paid 4 guineas to G.A.P.A.N. the only privilege I am conceded is that of watching humbly from afar while others become Freemen and Liverymen. For my 4 guineas I am not even a Member.

I do not wish to belong to G.A.P.A.N. I only wish to be a flying instructor. I am perfectly willing to pay 5s. a year to the Ministry for my Rating. Flying instructors are not rich people, especially part-timers like myself who may, if they are lucky, get just enough to cover their expenses.

Why, then, must our Rating be the most expensive, yet most under-privileged, of the lot? Why, when every other form of flying licence is controlled by the Ministry at a reasonable cost to the individual, should the Instructor's Rating be controlled by a private company which has no authority to issue Ratings and can only recommend them, at a most unreasonable cost to the individual?

Would the Ministry please consider issuing Instructors' Ratings for 5s. each alongside P.P.L.s and C.P.L.s, and would G.A.P.A.N. please explain what return ordinary flying instructors get for their money each year?

St. Albans, Herts. AUDREY OGILVY.

Those Vital Distances

MY letter (THE AEROPLANE, 30.5.58) in which I quoted Professor Richards' views at some length, in effect stated that if an aeroplane's ballistic trajectory lay closer to 19 ft. than 38 ft. then it was wrong and very unjust to the early aeronautical pioneers if the trajectory had to be "modified" to not much under 1,320 ft. through the air to prove a sustained and powered flight. Mr. Gibbs-Smith's reply is to devote one paragraph to the question under discussion and practically the whole of the remainder of his letter to the denigration of my late father, for which he apologizes.

I would like to reply, explaining why my father wrote the letters to which Mr. Gibbs-Smith refers and to his "nasty" (I cannot think of a better word) inferences. But to save your space I would recommend Mr. Gibbs-Smith to read, if he has not already done so, a letter from Col. J. T. C. Moore-Brabazon published in *Flight* (18.1.40) which, in so far as the June, 1908, flights are concerned, is practically identical to his own, and my father's reply in *Flight* (8.2.40).

With regard to the length of Orville Wright's first flight, if I am misinformed then so was F. C. Kelly, the authorized biographer of the Wright brothers, since he states: "The machine moved at only 10 feet per second. Quoting Orville Wright: 'This flight lasted only 12 seconds, but it was nevertheless the first in History.'. . ." Surely 10 ft. per second by 12 seconds equals 120 ft. over the ground? It was, no doubt, more through the air, but even stretching it as far as he can, i.e., 470-600 ft., Mr. Gibbs-Smith cannot get it to half the distance he now proclaims must be covered to make a proper flight.

Dealing with Santos-Dumont's first flight, I may well be misinformed, but my information was obtained from "A History of Flying" by C. H. Gibbs-Smith, in which he wrote: "At Bagatelle near Paris, on 12th November 1906 . . . Santos-Dumont won the French Aero Club's prize for the first public aeroplane flight in Europe *by covering 25 metres*." I regret I loosely stated 75 ft., not 82 ft. ½ in. But now Mr. Gibbs-Smith declares it was 722 ft. in 21 seconds. However, this controversy would not be taking place if he had stood by his original statement, which was in effect that 150 ft. constituted an unquestionable proper powered aeroplane flight — powered, sustained and controlled. (*R.Ae.S. Journal*, September, 1954).

Finally, there is no need for Mr. Gibbs-Smith or anyone else

Groundabout

G. T. White, M.B.E., F.M.D.G.M.T.H.B. The recent award of the M.B.E. to Mr. G. T. White, Armstrong Whitworth's armament division works manager, recalls another distinction he gained last year when the lorry carrying their Sea Slug to the S.B.A.C. Display collided with a car, shooting the missile into a hedge. Mr. White hurried to the scene and with difficulty persuaded the security guards to let him organize the exhibit's retrieval. He thus became the First Man to Drag a Guided Missile Through a Hedge Backwards.

*

They Also Suffer. Gordon Swanborough, who helps Tony Taylor with this magazine's airline reporting, is just back from a 15,000 mile tour of North America. He visited 21 aviation organizations, saw the first DC-8 flight, was the first journalist to fly in New York Airways' Vertol 44 helicopter service. He still found time for you columnees, bringing back from America gems of advice in the shape of signs such as:—

"Don't confuse me with facts—my mind is already made up."

"Reason? There is no reason, it's company policy."

"If at first you don't succeed, the hell with it!"

"Don't just sit there—WORRY!"

*

"I hear the cabins of these jets are so quiet that the loudest sound is the dripping of perspiration from the cabin staff."

*

Always Some Snag With Aviation. I'm told it's absolutely true that when a lavatory attendant at Hawker's was asked why he was quitting the job, he replied "I'm fed up with aircraft work."

*

Good Show. That active organization, the R.A.F. Association, knows how to be as graciously grateful as it is always helpful. After the Association's Hucknall Display, each of the pilots of 111 Squadron's aerobatic team received in the mail a little package which turned out to contain a lapel badge and Life Membership of the R.A.F.A.

*

by Gordon

to lean over backwards to accept that my father made hops of 100-150 ft. at Brooklands, as there are no less than five eye-witness' accounts stating they saw my father leave the ground, the maximum distance mentioned being 180 ft. There is also plenty of corroborative evidence. I feel I should mention in fairness to the "Gorell Committee," however, that this evidence was not all available to them when they sat to consider the question in 1928.

Warsash, Hants. G. VERDON-ROE.

"That First Quarter-mile"

I HAVE not followed in detail the correspondence leading up to Mr. Gibbs-Smith's letter quoted in your issue of June 13, and certainly I never intended to take a hand in the controversy.

On reading Mr. Gibbs-Smith's letter one might easily form a quite erroneous impression of my old friend A. V. Roe, and I would like to put in a word in his defence.

I first became actively concerned with aviation in the October of 1909 and joined A.V. in the spring of 1910, working in his little factory in Brownsfield Mill, in Manchester, for a while and then at Brooklands until the close of 1911, and subsequently towards the end of World War I, I was chosen by A.V. to start an Avro factory in the South of France, which as it happened never materialized.

Another link which enables me to speak with authority on this pioneer—F. P. Raynham, who was the Avro test pilot for years, joined me in the Air Survey Company, and often we would talk at length on these early efforts.

A.V. was a modest type and never "shot a line"! He had not the gift of expressing himself too well, either in conversation or in writing, leaving his listener to put the right interpretation on what he had to say, which we who knew him found no difficulty in doing.

In quoting A.V.'s letter to Wilbur Wright of August, 1908, Gibbs-Smith surely has left something out. I believe this letter, which was one part of the evidence submitted to the Gorell Committee, made it clear that the six tests were with the Antoinette engine, and I do not think there was meant to be any connection between these and the towed flights.

I am sure no one wishes to take FLY I away from Lord Brabazon, who made really lengthy flights in those early days and has done so much for us in aviation. I am personally grateful to him for his part in producing the first successful British air camera, which enabled me to carry out a successful air survey of 1,400 square miles in the winter of 1924/25.

I am satisfied, however, that A.V. must have *flown* with his 1908 aircraft, because by the arrangement of the undercarriage wheels, it was not possible to taxi at a speed in excess of lifting speed, tail held high with the elevator down, a reduced angle of attack and reduced resistance on the wings, and then as with subsequent types pull the stick back and bump the machine into the air for a short distance in a semi-stalled attitude.

Curdridge, Hants. R. C. KEMP.

World Gliding Championships

***Leszno Airfield, Poland*, 14.6.58.**

WITH the practice period now at an end, some assessment can be made of the chances of various pilots in the World Gliding Championships, which begin after the official opening ceremony on Sunday, June 15. Voluntary tasks have been set each day for four days, but they have all been speed tasks, mostly round triangular courses, with moderate winds blowing from between east and north throughout the period.

For Wednesday, June 11, the task was a race north-east to Sroda and back, 87 miles in all, but nobody completed the course. A few got part of the way back, and of the British team Tony Deane-Drummond nearly got there, Nicholas Goodhart went two-thirds of the way, and Philip Wills and Tony Goodhart, in the 15-metre class, did rather less.

Much the same proportionate performance followed on the next day, Thursday, when a 100-kilometre triangle (strictly 106 km.) was flown round; this time exact figures were issued, and showed Deane-Drummond in 9th place with a circuit time of 1 hr. 42 min., Wills 15th with 1 hr. 57 min., Nicholas Goodhart just behind him with 1 hr. 58 min., and Tony Goodhart in 22nd place, out of 30 entrants drawn from both the Open and Standard classes.

The most serious rival to Deane-Drummond's Olympia 419 is evidently the Yugoslav Meteor, which first appeared at the 1956 championships, when Aleksander Saradic flew it to 4th place. In this day's race Saradic took third place with 1 hr. 32 min. and his colleague, Bozidar Komac, in another Meteor, first place with only 1 hr. 14 min.

In the Standard 15-metre class Heinrich Huth of Germany put up the best performance with 1 hr. 34 min. in a Ka-6 (also known as Rhönsegler), but did not maintain this high standard on the following days. The most promising pilot in the Standard class appears, so far, to be Adam Witek, of Poland, with a hotted-up Mucha known as the Mucha-Standart. There was an alternative task the same day—a 51-mile race to Wroclaw (formerly Breslau), and Witek, though he only came 15th in the triangle task, set off immediately afterwards for Wroclaw and won the race in 50 minutes against nine others, seven of whom flew Open class machines.

The most "fancy" product in the Standard class, the Breguet 905, has not particularly distinguished itself yet. Nor, incidentally, have the Russians in either class.

Marian Gorzelak, of Poland, who finished third in the previous championships, came 10th in the triangular race and second in the Wroclaw race (with 54 min.), and appears to be the "home" team's most serious rival to the British in the Open class. But, though a first-class pilot, he flies the quantity-produced Jaskolka, a type which many visiting pilots have borrowed, and although this is a very fine machine, its wings cannot be described as laminar-flow by the most modern standards. However, weak thermals will favour it against the laminar-flow machines, which demand strong thermals so that they can spend a greater proportion of the time going at high speed from one to the next; and so far the thermals have only averaged 2 or 3 metres per second.

On Friday, June 13, a 200-km. triangle was set (strictly 208 km.). The Yugoslav Meteor was still to the fore, Komac making the fast time of 2 hr. 36 min. 5 sec. But he was just beaten to it, by a 15-sec. margin, by Ernst-Günther Haase, of Germany, with the warping-wing HKS-3, which can change its wing-section in flight; evidently Haase is in better form than last time. Edward Makula of Poland came third, and Saradic, with the second Yugoslav Meteor, fourth.

Of the British team, Deane-Drummond and Nicholas Goodhart took 9th and 10th places with 2 hr. 51 min. and 2 hr. 52 min., the former putting up a new British national record. In the Standard class Silesmo of Sweden did best in 12th place and Witek was 14th, Tony Goodhart 21st and Wills 25th in a field of 43 who got round.

The last practice day was given to a 300-km. triangular race; Saradic with his Meteor won it in about 3 hr. 54 min., and Deane-Drummond was possibly a little faster than Nicholas Goodhart with about 4 hr. 24 min., but exact figures are not yet out. John Williamson, the British reserve pilot, was lent the Olympia 415 (Standard class) and, flying it for the first time, got round in 5¼ hours, which was good going in the circumstances.

Philip Wills set off to do two sides of the triangle as far as Wroclaw, so as to be officially observed at the turning points, and then to continue south-eastwards as far as he could go, in the hope of earning a diamond for 500 kilometres. After 8½ hours in the air he landed among the Tatra Mountains near the Czechoslovak border, having covered 185 km. (301 miles). It took him and his team until 11.30 next morning to get back.

The official opening on Sunday, June 15, was performed by the Polish Prime Minister, M. Josef Cyrankiewicz. An original feature during the speeches was the release upwind of 22 balloons, each trailing the flag of one of the nations represented. Their performance varied greatly; some got into thermals and were last seen near cloud base, while others, including the British, scarcely passed their "A" certificate. After that, 25,000 carrier pigeons (the official figure) were released to carry the good news all over Poland.

Then came some staggering sailplane aerobatics, including three machines going round the same vertical circle in continuous loops, a Polish Bocian circling upside-down, apparently in a thermal, and a Jaskolka launched by a helicopter, which started by dropping a tow-line to it and finished by dangling it vertically like a fish on a line.

General opinion in the British team is that, in the Open class, Tony Deane-Drummond and Nicholas Goodhart are among the very few in the top rank, and stand a good chance against the Meteor if the thermals are not too consistently strong; the Standard class, on the other hand, contains such a heterogeneous collection that nobody will venture an opinion, but I still think Witek is the man to watch.—A. E. SLATER.

Per Ardua ad Australia—III

DAVID HILL, flying his Prentice "Koomela," accompanied by his wife Merete, continues the story of his flight from Southend, England, to Melbourne, Australia.*

TWO weeks after setting out from Southend, England, we landed at Bahrain Airport, on Muharraq Island, in the Persian Gulf on March 19. We had just flown from Baghdad in five hours, and my wife, Merete, and I were glad to stretch our legs. I was quite surprised to find that Bahrain was a busy airfield, and while we refuelled and went through the usual formalities, "Koomela" was joined by a Kuwait Airways DC-3, a B.O.A.C. Constellation, a Super Constellation of K.L.M. operating an Air Ceylon service, a DC-4 of an airline I had never heard of before, a private American Beaver, two Doves and two Herons of Gulf Aviation, an R.A.F. Canberra, and the one that surprised me most, a Bomber Command Vulcan.

We crossed to the island of Bahrain itself by a long causeway, and made our way to the comfort of the B.O.A.C. hotel, Speedbird House. We strolled around the town, wondered at the mixture of East and West, European, Arab, Indian and African, old and new, and came back to reality with the purchase of cigarettes for the smoker in our family, which is not me.

Our Bahrain stay was a pleasant, if expensive one, and next day we left the hotel bright and early for our next hop, 360 nautical miles to Sharjah. The straight line track is almost one hundred miles less than this distance, but we decided we would prefer to fly the longer distance and stay over land rather than take the direct track. Das Island, with its airstrip, is a diversion for the overwater crossing, but the coastal hug provided many more airstrips.

Flying conditions were very smooth, and the monotony of the desert was broken now and then by a small town and an occasional road. We spotted an aeroplane on the ground near one such town, and it turned out to be a Gulf Aviation Heron at rest on a desert airstrip. How their pilots can decide which is airstrip and which is desert is beyond me, but perhaps it does not make much difference!

Nearing our destination the silence on the radio was suddenly broken by Red Leader calling his Number Two. I was surprised to find two Venoms taxi-ing out at Sharjah. I was so fascinated I did not really listen to my landing instructions, and ignored the short, into wind, runway that I was offered, and landed 45 degrees cross wind on the Venom's runway.

At last we found an airport with no transportation problem! The aircraft was picketed just outside the old fort, and we lived inside, just a few paces away. The place is operated by International Aeradio, and their airfield staff live there. After having lunch, for the second day running, we strolled round outside and saw to our satisfaction that the place was well guarded by the colourful locals.

Flt. Lt. Colin Richardson, acting C.O. of the R.A.F. camp, came up to us, apologized for not meeting us sooner but he was flying, and said that if we felt thirsty they were keeping the bar open for us.

Later they showed Merete their Venoms, and she felt elated at sitting in a real fighter and knowing a little of what it was all about. They invited us back after dinner, so we dropped in for a few for the road, and then walked back to the fort, breathed the warm night air, and gazed at a sky full of stars. John, Tich, and Colin, all three of No. 8 Squadron—thanks for a very enjoyable stay at Sharjah.

The next day we flew from the Arab world to the Pakistani world. Three and a half hours flying over desolate, but impressive, coastline, took us to the Pakistan staging post at Jiwani. We were greeted with the usual insect bomb welcome, but once the formalities were over we were given a real welcome.

We really enjoyed a cup of tea, but unfortunately had to turn down an invitation to lunch because of the time factor. Their only connection with the outside world is an occasional unscheduled aircraft, and a supply convoy every now and then, so they were very glad to see us and we left with a whole stack of mail to post at Karachi.

The next leg took just under three hours, and we managed to sort out an abundance of airfields around Karachi and land at the right one. Here the Burmah-Shell man took us under his wing, and in no time at all we had refuelled and parked the aircraft, and disposed of all the usual formalities. He really went to a lot of trouble over us, and saw to it that we had no difficulties. All this, I might add, for our 63 gallons of fuel.

We stopped at the Airport Hotel because it was so very convenient, and found it very comfortable, and particularly reasonable after the high cost of accommodation at Bahrain and Sharjah. The sound of the airlines of the world coming and going lulled us to sleep, and I slept really soundly until the alarm clock sang its unwelcome song at an impossible hour.

Next stop was India, the fascinating land of extremes. We flew over mud, scrub and salt pans to arrive at Ahmedabad, where again the Burmah-Shell representative gave us the red carpet treatment, and even loaned us his car and driver to take us to town. Before that, however, we had to go through The Formalities. And transitting India, it turned out, is not as easy as transitting other countries. Forms have to be filled out, books filled in, agreements made and declarations made. It would be amusing if it were not so tedious.

But everyone was very friendly, and we were always beckoned to a chair with a flourish as we entered each office in turn. However, I will say this about flying through India—their landing fees were the cheapest we had come across. It cost us 1s. 6d. for landing, 1s. 6d. for parking, and at Ahmedabad we had "Koomela" hangared for a further 1s. 6d.

Next day was Sunday, and we had intended to have a day off, as was our custom. But we both decided that Ahmedabad was not our cup of tea, and I said "Let's press on to Singapore, and have our day off there." So instead of our usual rest, we got up early and caught a taxi to the airport. We flew first to Bhopal where we made a short refuelling stop, and then to Allahabad. We had been warned that thunderstorms were possible later in the day, but we had a pleasant run in very good flying conditions.

The first thing we did at Allahabad was to have a cold drink, and in the restaurant there we started talking to a European, who had arrived in a Beech Expediter. Hearing that we were night-stopping in Calcutta next evening, he very kindly offered to put us up, and we were very grateful in accepting.

When we landed at the airport on Sunday afternoon, it was deserted except for the Expediter which came and went. Next morning, however, it was different. Allahabad is the home of the Government of India Commercial Aviation Training Centre, where students do basic training and graduate onto DC-3s preparatory to going into commercial flying, and the place really hummed with activity. HT-2's came and went, Chipmunks too, and to our surprise a yellow-painted Prentice in Indian Air Force markings pounded the circuit. "Koomela" really felt at home here! But we had no time to linger, and

* Previous instalments appeared on May 30 and June 13.

AT SHARJAH.—(L. to R.) Flt. Lt. Colin Richardson with Flg. Offs. "Tich" Kennedy and John Mayes (No. 8 Sqn. R.A.F.) with Merete.

Golf Alfa Oscar November Sierra taxied, took off, and cleared the circuit for Calcutta.

Calcutta was 407 nautical miles away, but as it turned out it was a bit farther than that. It got rather hazy as we neared our destination, and after my last check point about 20 miles out I relaxed my attention and sat back to wait for Dum Dum Airport to appear. I informed Approach that I would be overhead in ten minutes and after seven or eight minutes I strained forward in my seat to pick up the airfield.

At last the Hooghly river came into view, but it was not quite the shape that it should have been, so I estimated I was to port of track and turn starboard. If I had estimated the opposite, I would have been correct, and when Dum Dum called me and asked was I overhead I had rather shame-facedly to report that my ETA was, er, in ten more minutes' time. I have, of course, been lost on many occasions in the past, but this time it hurt because I was paying for the extra petrol myself.

After putting our aircraft to bed for the night, and satisfying the numerous officials, we took a taxi to the home of Mr. E. W. Green, to take him up on his offer of a bed for the night. It turned out that Mr. Green was the Technical Director for India and General Manager of Simon-Carves Limited, the large engineering organization, and his home was quite beautiful. Merete and I "roughed it" in a magnificent air-conditioned, self-contained flat, and were so grateful to find ourselves amongst such pleasant surroundings. Mr. and Mrs. Green really gave us an enjoyable stay.

Simon-Carves, I learned, have two aircraft, the Expediter we had seen at Allahabad, and a Beech Traveller, which is a very unusual aircraft these days, and they use them frequently to make executive travel quicker and easier.

The Land of Pagodas—and Smiles

As "Koomela" lifted her wheels off the runway at Dum Dum Airport, Calcutta, all of us breathed sighs of relief. First "Koomela" herself, she is never really happy on the ground and is glad to get airborne, then Merete and I, as we were leaving India and heading towards more pleasant parts of the world.

Our destination was Akyab, Burma, and when planning this leg, we applied, as usual, the Single-engined Pilot's First Principle: The shortest distance between two points may use less petrol, but it often uses more sweat. So we made our first track almost due east, and headed for Chittagong, East Pakistan. For the first hour we flew across the dozens of streams, rivers and islands that make up the mouths of the Ganges River, most of the time uncertain of our position, until we finally came to clear water and then the coast at Chittagong.

We radioed them our position and flight conditions, which were nicely VMC at 3,000 ft., and turned on to a more southerly heading for Akyab. Gone was the drab, dry brownness of India, and in its place we had rich red soil and dark green foliage, as jungle reached down to the sea. We crossed the Burma-Pakistan border just east of Cox's Bazaar, and shortly afterwards touched down on the PSP runway at Akyab, just over three hours' flying time from Calcutta.

Our arrival was something of a surprise, because no word of our flight had been received that day, but they quickly notified everyone concerned, and soon refuelling was under way and the Customs and immigration officials had arrived from town. We enjoyed a welcome cold drink in the palm-thatched airport building, and the usual arrival procedure was conducted quickly and efficiently.

No one tried playing at Big Important Officials here, they just got on with their jobs and enjoyed a few jokes with us. In fact one thing that struck us immediately was that people were smiling all the time, and they were clean.

Despite our unannounced arrival we were airborne again in just over an hour, and heading south-east. For the first hour we had coastline to guide us, and then had to climb to 5,000 ft. and head inland for Rangoon. The weather was somewhat hazy, with visibility "down" to around seven or eight miles (guffaws from European pilots!), and so we spent half an hour or so "uncertain of our position." Eventually the Irrawaddy River meandered across in our general direction, and we found ourselves again, and still going in the right direction.

The 1 in 1,000,000 scale maps we were using were not always very accurate, and not very detailed for such a flight, so that it was not always possible to fix our position very accurately. However, they were quite adequate for general navigation purposes, and certainly very convenient in the cockpit. All my basic flight planning had been done before we left England, tracks and distances worked out, maps joined together, and I found this to be a great help in making the trip as trouble-free as possible.

In addition, radio facilities were written in alongside each airfield, to reduce the amount of paper work necessary in the cockpit, and this also proved useful.

We landed at Rangoon just before five o'clock local time, and just over two and a half hours' flight time from Akyab. We taxied past rows of Burmese Air Force aircraft, all in the training-transport categories, and parked not far from a Chinese Communist IL-14. As usual our first task was to refuel the aircraft, and while doing so an immigration official came up to us and asked us to check with his department. We said we would certainly do so, but wished to refuel and park the aircraft first. We took on 40 gallons, parked "Koomela" in front of the very modern terminal building, and then went inside to clear through Immigration and Customs.

The Burma Oil chap was a tower of strength, and after battling with Immigration on our behalf saw us through Customs, who were no trouble, took me to Flight Planning and Met., helped us with our kit, and organized us a ride into town on the Cathay Pacific bus. All this was part of the service for perhaps the least lucrative customer they have ever had.

We had quite a long ride into town, and were grateful we were having it per courtesy of Cathay Pacific and not by taxi. We had decided to stay at one of the lesser hotels, but the C.P.A. hostess said she could probably get us a room in the best hotel for only slightly more, and it was well worth the extra. We took her word for it, and ended up in the best hotel along with all her passengers.

After a walk round part of town, and a look at the attractive Sule Pagoda, we just made dinner back at the hotel. We had just sat down when I sensed a figure approaching from the rear, who came up behind Merete, put his arms round her and gave her a big kiss. I was speechless! Thoughts flashed through my head—the manager, an old Burmese custom maybe? But no, he was fair-haired. And then the head turned and I recognized Merete's cousin Torben. The relief!

We liked Rangoon, the people were clean and friendly, the houses tidy and attractive, but as usual we had to be up early next morning to continue our voyage. Torben came with us to the airport, and it was pleasant to have a member of the family to wave us on our way.

After taking off from Rangoon (March 26) we stayed at 1,000 ft. for a while, to keep underneath a layer of lifted stratus, but it soon cleared and we climbed to our usual 3,000 ft. We had another coast-crawl, after a short sea crossing, and traversed 4½° of latitude to land at Mergui.

Burma is truly the land of pagodas, and we must have seen hundreds as we flew over the undulating blanket of green. But the one we will remember the most was just off the end of the runway at Mergui. After we had taken on our share of fuel and cold drinks, we bid the friendly Burmese farewell, and took off for Butterworth. Just after becoming safely airborne we spotted this beautiful pagoda, standing white against a brown and green hill, and I grabbed my camera to try to get a shot. Click, click, click—and nothing happened. As had occurred once or twice before, it jammed, and for the rest of that trip Rolly was in complete and utter disgrace.

Our destination this time was the Royal Air Force airfield at Butterworth, opposite Penang Island. When we had originally planned our sortie Penang airfield was closed, and traffic was passing through Butterworth, and whilst we had heard that Penang was now open again, we decided to stick to our original routeing.

This leg was 450 nautical miles, another coastal hug, so quite easy from the navigational point of view. Without any noticeable difference Burma gave way to Thailand, and then Thailand to Malaya. Four hours and 20 minutes after taking off from Mergui we touched down on the nice new runway at Butterworth, making just over seven and a half hours' flying for the day. We felt quite weary. But at Butterworth the R.A.F. boys leapt into action, and for once I left "Koomela" entirely in their hands for refuelling and bedding down.

A short ferry ride took us to Georgetown, Penang Island, and we found the sergeant's choice of a hotel a very good one. Penang looked very picturesque, and worthy of further exploration, but that was not to be. We still had a long way to go, and besides we were anxious to get to Singapore to see how the Indonesian situation was.

We arrived at Butterworth next morning simultaneously with a large gentleman, who asked at the guardroom for the pilot of the Prentice. "That's me," I said, and he introduced himself as "Gus" Haining, from up the road. The name and accent seemed familiar, and I asked did he have a brother in the Air Force, known as "Hoose." Yes he did have, and I explained that "Hoose" was once my flight commander. Small world. "Hoose" is tall and broad; "Gus" is tall and broader, which is quite something.

"Gus" keeps an Auster at Penang airfield and, whilst red tape is thickening a bit, it is still most useful for getting around the country. He told us to go straight to the Flying Club when we landed at Kuala Lumpur, make ourselves known on his introduction, and we would be looked after. He was right. This was the beginning of Malayan hospitality.

(To be continued)

Hobson's Latest Products

MICROJET pressure-ratio control units are being produced by H. M. Hobson, Ltd., at Wolverhampton, under licence from the Solar Aircraft Company of San Diego, California. Initial applications of this control are on turbojet engines but it is expected to find other uses in industry.

Production of the Microjet control extends the wide range of Hobson products. These are well known throughout the aircraft industry, for which the company produces hydraulic and electro-hydraulic powered flying controls, servo actuators for aircraft autopilot and autostabilizer systems and missile control systems, fuel control systems for aircraft and missiles and constant-speed alternator drives. The company also has a nuclear engineering department. Its activities include the design and production of reactor control systems, isotope-production units and manipulators for the remote handling of radio-active materials.

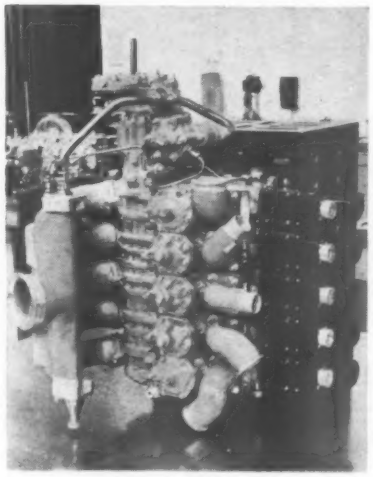
The Microjet pressure-ratio control can be used to maintain a predetermined ratio between two pressures regardless of their absolute value. It produces an output which is proportional to the error in pressure ratio.

The accompanying diagram shows the Microjet in a simple form. Basically it consists of a cast metal case in which two chambers are separated by a flexible diaphragm to which is attached a taper-needle. A lead from the high-pressure source is connected via a fixed orifice (which can be fitted with a trimmer needle if required) to the compartment on the needle side of the diaphragm. This compartment is vented to the atmosphere via an orifice the size of which is controlled by the position of the diaphragm needle. Thus, between the two orifices there is a pressure KP_1 which is a predetermined fraction of the original pressure P_1; this reference pressure KP_1 acts on the underside of the diaphragm.

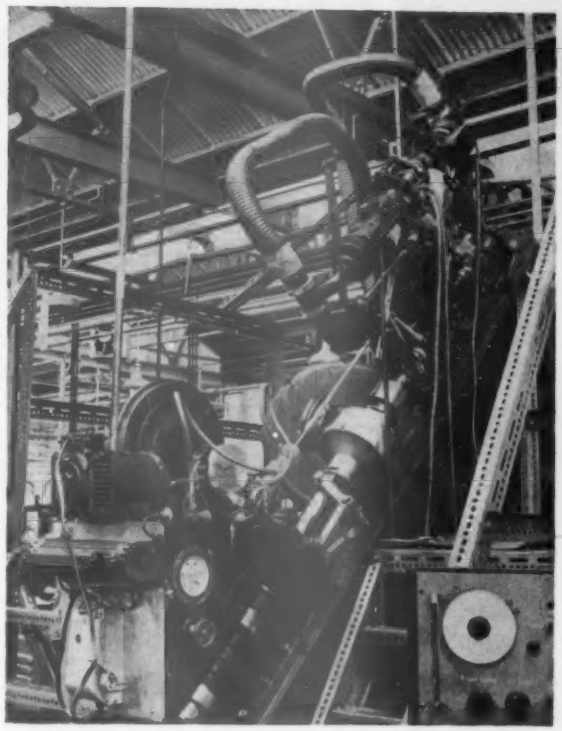
A lead from the lower pressure source P_2 is taken directly into the compartment above the diaphragm, and P_2 is equated via the diaphragm to the reference pressure. Thus, when the taper needle is in its datum position the pressure P_2 is a predetermined fraction of pressure P_1.

Any deviation from the desired pressure ratio affects the balance of pressures on the diaphragm, and the taper needle moves a distance which is proportional to the error. This movement can be made to operate controls which restore the correct pressure ratio.

The first Hobson application of the Microjet is on the variable-reheat system of the Gyron Junior turbojet engine. The Microjet supplies signals to the controls which vary the area of the reheat nozzle so that a constant pressure ratio is maintained across the turbine. On this particular installation there is also a Mach number over-ride which cuts out the Microjet to provide a supersonic convergent-divergent nozzle when more than 90% reheat is selected.



This fuel-flow proportioner for a V-bomber takes fuel simultaneously from five tanks at a rate which is in each case proportional to the size of the tank.



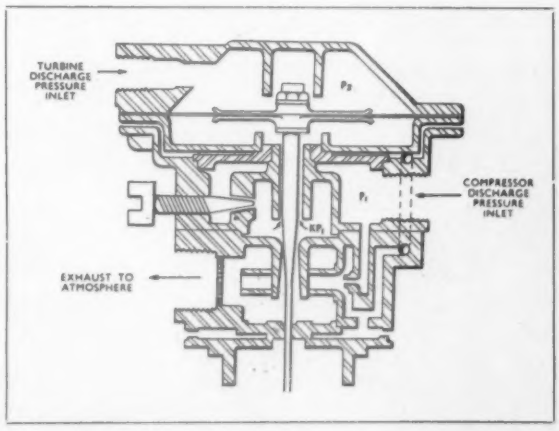
Powered flying-control units for a V-bomber undergo life tests so that their overhaul period can be extended.

The Microjet can also be used to indicate shock-wave position in supersonic intakes and to control the operating conditions of air compressors and gas turbines. It can also act as a control in the mixing of fluids and gases. A more elaborate Microjet with two diaphragms could act as a Machmeter for aircraft or missiles.

A new Hobson development is the production of fuel-flow proportioner units for the latest version of a V-bomber. Three of these units are installed, two for the port and starboard wing tanks respectively and the third for fuselage tanks.

Fuel lines from individual tanks are connected to the proportioner which delivers fuel through a single pipe. The proportioner is so arranged that fuel is fed from each tank at a rate which depends on tank size. This ensures that tanks are emptied evenly to maintain the aircraft's centre-of-gravity position within the required limits.

The proportioner acts in reverse when the aircraft is pressure-refuelled. By passing fuel through it the tanks are filled simultaneously at flow rates proportional to tank size.—J.R.C.



The working of this Microjet pressure-ratio control is described in the text.

NOTES AND EVENTS

CHANGE OF NAME.—Aero Research, Ltd., of Duxford, announce that the name of the company is to be changed to CIBA (A.R.L.), Ltd., with effect from June 30. This name has been chosen because the company feels that Aero Research is no longer appropriate in view of the many industries served by its products and also because it wishes to emphasize its affiliation to the CIBA organization. The trade names of Aerolite, Araldite, Redux and other proprietary products are unaffected.

FOR AERIAL FARMERS.—A European Agricultural Aviation Centre is to be set up at The Hague under the auspices of the Organization for European Economic Co-operation. Its purpose is to exchange information with member countries on matters concerning agricultural aviation in Europe and elsewhere and to advise on its development. At present Great Britain, France, Denmark, Italy, Germany, the Netherlands, Spain and Sweden are members.

BRITISH STANDARD.—Now available from the B.S.I. is a revised British Standard, 3G.131—"Lead/acid batteries (non-aerobatic) for aircraft." Copies are obtainable from the B.S.I., 2 Park Street, London, W.1, price 6s.

CONTROL ACQUIRED.—Roto-Finish, Ltd., of Hemel Hempstead have acquired from Jacquet-Hispano Suiza, S.A., the controlling interest in Modern Electrolytic Patents and Processes, Ltd., specialists in the electropolishing of metals. There will now be the closest liaison between the two companies and a joint service will be available to determine the most suitable and economical process for deburring or polishing components.

TRADE AGREEMENT.—Canadian Applied Research, Ltd., of Toronto, has completed an agreement with Robot Berning and Co., of Dusseldorf, West Germany, whereby they will handle its products (cameras) in Canada.

AERIAL SURVEY.—The Photographic Survey Corpn. has been awarded a contract for the aerial mapping of 220,000 sq. miles of the Canadian Arctic archipelago. This is part of a 500,000-sq. mile project being undertaken by the Canadian Government. Two converted Boeing B-17s will be operated on behalf of P.S.C. by its flying division, Kenting Aviation, Ltd. The aircraft have been fitted with long-range tanks giving them more than 15 hours endurance. The photography will be done from 30,000 ft.

CANADIAN COMMEMORATION.—This medallion (both sides are shown) was issued by the Canadian British Aluminium Co., Ltd., to commemorate the production of the first aluminium ingots at its new smelter at Baie Comeau, Quebec.

CASTROL H.Q.—Under construction in Marylebone Road, London, N.W.1, is the new headquarters of the Wakefield Group of companies. An island site will be covered by the ground and first floors only and these will be surmounted by a tower reaching to a total height of 16 storeys and 170 ft. The new building will be called Castrol House and is expected to be completed by the end of 1959.

SOUTHERN AGENT.—Sheepbridge Alloy Castings, Ltd., specialists in heat and corrosion-resisting alloys, has appointed E. H. Bennet and Son, of 124 Seymour Place, London, W.1, as its southern area representatives.

DUNLOP'S YEAR.—At the recent A.G.M. of the Dunlop Rubber Co., Ltd., the chairman, Mr. G. E. Beharrell, said that the company's aviation division is now producing parts for guided missiles. Considerable research and development work has been done in connection with new products. Sales of wheels, brakes, and Maxaret anti-skid units at home and overseas were substantially greater than in 1956 but there were fewer sales of aeroplane tyres. Exports in 1957 were a record and many important orders had been received from overseas aircraft manufacturers.

NEW ADDRESS.—The Birmingham branch of the English Electric Co., Ltd., has moved from 75 New Street to larger premises at Pitmaston, Moseley, Birmingham, 13. The telephone number is South 4021-5.

Aviation Calendar

June 28.—R.A.F.A. Air Display at **Exeter Airport.**

June 28.—R.A.F.A. Air Display at **Staverton Aerodrome,** Gloucester.

June 28.—R.N.A.S. **Abbotsinch** "At Home."

June 28-30.—R.Ae.C. Invitation Air Rally, at **La Baule,** France.

July 4.—Presentation Ball of College of Aeronautics Students' Society, at Lanchester Hall, **Cranfield,** Beds, 22.00 hrs.-05.00 hrs.

July 5.—NATO Air Display at **Soesterberg,** Holland, at 15.00 hrs.

July 5-6.—12th Rally of the Wings and Chateaux, organized by Aéro-Club de l'Ouest at **Anjou,** France.

July 5-6.—Professional Race Pilots' Association Air Races at **Fulton, New York.**

July 5-7.—R.Ae.C. Invitation Air Rally, at **Deauville,** Calvados, France.

July 8-11.—Institute of the Aeronautical Sciences, National Summer Meeting at **Los Angeles,** California.

July 10-12.—National Air Races and British Lockheed International Aerobatic Competition, organized by the R.Ae.C., at **Baginton,** Coventry.

July 13.—Wolverhampton Aero Club "At Home," at **Wolverhampton Airport.**

July 13.—Leicestershire Aero Club "At Home," at **Leicester East Aerodrome.**

July 16.—Kronfeld Club talk, "The London Gliding Club," by Dudley Hiscox, at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

July 19.—R.N.A.S. **Eglinton** "At Home."

July 19.—R.N.A.S. **Culdrose** "At Home."

July 19-20.—Caen Rally organized by the Calvados Aero Club, **France.**

July 20.—Air Display organized by the Fair Oaks Aero Club, at **Fair Oaks Aerodrome,** Surrey.

July 26.—R.N.A.S. **Lossiemouth** "At Home."

July 26-27.—Tour of the Dolomites arranged by the Trente and Bolzano Aero Clubs, **Italy.**

July 26-August 4.—National Soaring Week organized by the B.G.A.

New Patents

APPLICATIONS ACCEPTED

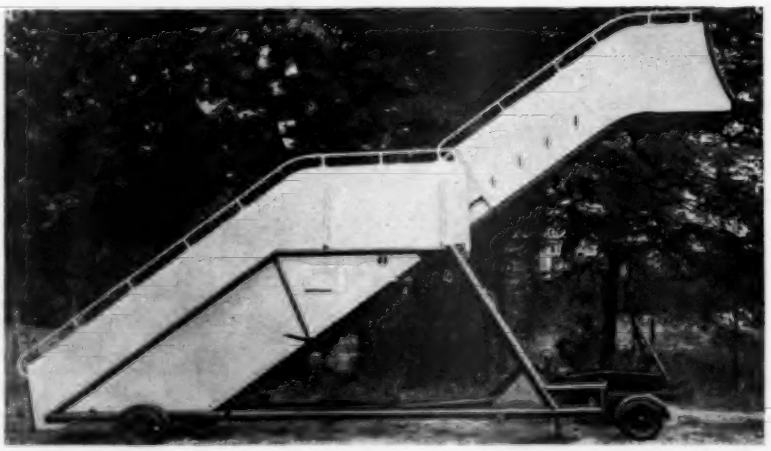
799,290.—Fairey Aviation Co., Ltd.—"Aircraft tail assemblies."—Sept. 14, 1955 (Sept. 20, 1954).

799,296.—United Aircraft Corpn.—"Airplanes having a pivotal nose section."—June 26, 1956 (July 11, 1955).

Applications open to public inspection on August 6, 1958; opposition period expires on November 6, 1958.

NEW COMPANY

Yorkshire Line (Manchester), Ltd. (605,697).—Private co. Reg. June 4. Cap. £100 in £1 shs. Objects: To carry on the business of general, forwarding and transport agents, carriers by sea, land and air, etc. Subscribers (each with one sh.): Samuel E. Rubinstein, solicitor, and Laurence B. Marks, both of Connaught Court, Connaught Street, W.2. Director: Patrick B. Laming, Culbone, Crown Lane, Cwmbran, director of Marenion, Ltd. Sec.: Maximilian Gluck. Reg. off.: 11 New St., London, E.C.2.



ALL-PURPOSE STAIRS.—The Spurling aircraft stairway seen here can be adjusted quickly and mechanically for aircraft door-sill heights from 6 ft. 3 in. to 10 ft. 7½ in. and can thus be used for nearly all civil aircraft in service or now coming into service. They are designed and made by Spurling Motor Bodies Ltd., Edgware Road, The Hyde, London, N.W.9.